



# **Rat** **CONTROL**

**for Alaska Waterfront Facilities**

Published by Alaska Sea Grant for  
Alaska Department of Fish and Game

# **Rat Control for Alaska Waterfront Facilities**

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Alaska Sea Grant  
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# **Part I:**

## **Technology and Methods**





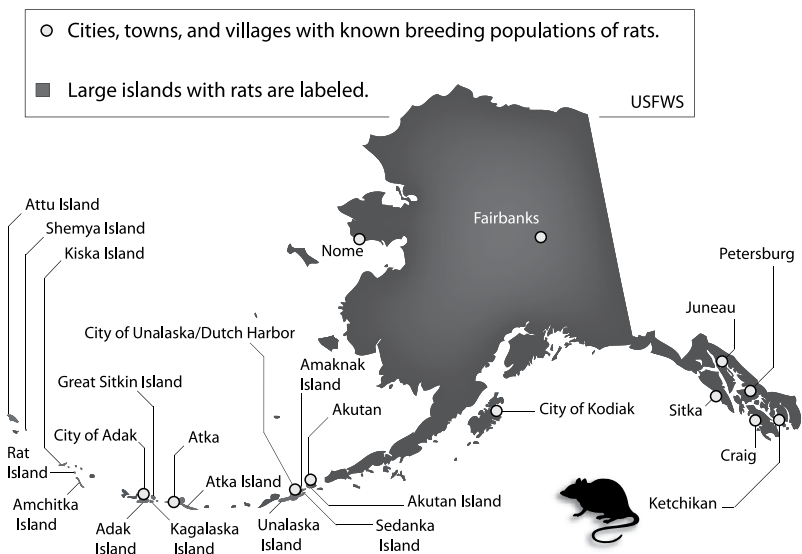
# 1.

## Introduction

The rat is called the “third most successful mammal in the world”—after the human and the house mouse—because of its spread across the globe, its adaptation to a wide range of environments, and its ability to thrive in close proximity to its chief enemy and benefactor, man. The rat’s successes impose costs on its hosts and neighbors: disease and contamination, destruction of food and other goods, damage to equipment and infrastructure, and devastation of wild bird populations and other wildlife.

The rat’s position in world order is so well established that it may be surprising to learn that there are still towns, ports, and islands that are entirely rat-free. (See the map indicating Alaska’s infested and rat-free locations.) The purpose of this manual is to offer operators of waterfront facilities information that will help them to control the numbers of rats and suppress the movement of rats through waterborne commerce, so that those locations remain rat-free.

### WHERE THE RATS ARE



#### 4 *Rat Control for Alaska Waterfront Facilities*

The focus is on the Norway rat, which is much more common in Alaska than the roof rat and other nonnative species.

This publication is intended to provide operators whose ports and facilities already have rats with tools they can use to keep local rat populations as low as possible, thus minimizing risks to human health and to property, including equipment, buildings, vessels, cargo, and products.

A regulation adopted by the Alaska Board of Game in 2007 (see sidebar) makes it illegal to transport or harbor rats and mice anywhere in Alaska. Operators of ports, boat harbors, fish processing plants, cargo terminals, and vessels transiting Alaska waters are bound by the regulation and may be prosecuted if rats or mice are found on their property. This manual can help those operators come into compliance.

The chapters and appendices in this book offer information on the following topics:

- The rat, its characteristics, capabilities, and threats.
- The principles of rat control and Integrated Pest Management.
- Specific control methods, including toxicants and traps.
- Establishing and managing a rat control program.
- Recommendations for vessels and food processing plants.
- Checklists for organizing site-specific rat control measures.

While this book primarily targets Alaska ports, it is useful in waterfront facilities worldwide.

## ALASKA REGULATION

In 2007 the Alaska Board of Game passed the following regulation pertaining rodents in the family Muridae (Norway rat, roof rat, house mouse, and certain other invasives):

### **5AAC 92.141. Transport, harboring, or release of live Muridae rodents prohibited.**

- a** It is unlawful for the owner or operator of a vessel, vehicle, aircraft, structure being translocated, or other means of conveyance to knowingly or unknowingly harbor live Muridae rodents, or to enter Alaska (including Alaskan waters) while knowingly or unknowingly harboring live Muridae rodents.
- b** It is unlawful for an individual to release to the wild any live Muridae rodent.
- c** It is unlawful for the owner or operator of a facility to knowingly or unknowingly harbor live Muridae rodents. The owner or operator of a harbor, port, airport, or food processing facility in which live Muridae rodents have been found shall develop and implement an ongoing rodent response and eradication or control plan.

In addition, **5 AAC 92.230** Feeding of game reads: Except under terms of a permit issued by the department, a person may not intentionally feed a moose, deer, elk, bear, wolf, fox, wolverine, or deleterious exotic wildlife, or negligently leave human food, pet food, or garbage in a manner that attracts these animals. However, this prohibition does not apply to use of bait for trapping furbearers or deleterious exotic wildlife, or hunting black bears, wolf, fox or wolverine under 5 AAC 84–5 AAC 92.

**5 AAC 92.990** defines “deleterious exotic wildlife” to include any Muridae rodent.

Violations are a Class A misdemeanor and require mandatory court appearance (unless identified as a bailable violation). For individuals, penalty can be a fine of up to \$10,000 and up to one year in jail. For organizations (including businesses and agencies) the penalty can be a fine of up to \$200,000 and up to three times the financial gain realized by the defendant as result of the offense, or up to three times the financial damage caused to another as result of the offense.



# 2.

## Meet the Enemy

The Norway rat (*Rattus norvegicus*) and the roof rat (*Rattus rattus*) are members of the family Muridae (mouse-like animals), which has about 500 species. As **rodents** (derived from the Latin for “to gnaw”), they belong to the largest order of mammals, with 1,700 species. Norway and roof rats share many traits: they are **commensal** (“share the table” with us), relatively secretive, nocturnal, and live by taking what they need from us. Norway rats are burrowing animals.



The average size of an adult Norway rat is 16 inches long (including tail) and 0.8-1.0 lb. Steve Ebbert, USFWS.

## NORWAY RAT

Norway rats are invasive species with origins in Asia. They've been on this continent for more than two centuries. In Alaska, the Norway rat is believed to have first arrived in the western Aleutians with Japanese or Russian exploring or trading vessels in the eighteenth century, and military shipping may have introduced it to ports in Southeast Alaska during the 1940s.

### Morphology and physiology

All the Muridae have compact, flexible bodies suited to life in tight quarters. They can squeeze through any opening large enough to accommodate their skulls. Their **fur** is sufficient to allow survival in fairly cold conditions, but they do not thrive in the Arctic, and favor warmth where available. Long **tails** provide balance and leverage for climbing and jumping, and are used for **thermoregulation** (maintenance of body temperature) by radiating excess heat during warm weather. Hind feet have five toes with claws and front feet have four. Rats are powerful diggers.

All have long **incisors** (front teeth) used for gnawing and can cut through wood, plastic, wire, and even sheet metal. Their instinct for gnawing derives from their diet in the wild of nuts, seeds, bark, and stems. They also gnaw to shred nesting materials; this urge to gnaw is the cause of much of their damage to materials and infrastructure.

Rats are colorblind and their visual range is short, but their **eyes** are adapted for low light conditions and they detect motion at great distance. Their sense of **taste** allows them to detect contaminants in food. Their **hearing** is good—they can hear ultrasonic frequencies far beyond the range of human hearing, allowing them to communicate and navigate in the dark ultrasonically.

All have an acute sense of **smell**. As rodents travel through their habitat they leave grease trails, as well as feces and urine, all rich in odors and **pheromones** (chemical substances that influence patterns of behavior in others of the same species). By smelling the leavings of others a rodent can find popular travel routes and food sources, and can determine the gender, state of mating readiness, strength, and colony affiliation of individual animals.

Muridae rodent movement is governed in part by **thigmotaxis**, which means they orient their movements in their dark and complex environment largely through sense of touch. **Vibrissae**, including four specially evolved “whiskers” on the face and additional hairs on other parts of the body, serve as sensory organs that allow them to feel and interpret the shapes of the spaces

and objects they encounter. With a sort of “muscle memory” they can retrace routes originally developed with odor and touch cues.

## Life history and behavior

All Muridae rodents mature at an early age, breed frequently, have short gestation periods, produce multiple offspring, and have brief life spans. Some species breed year-round, but Norway rats are most prolific in spring and fall. In ideal conditions they can produce a new litter (four to ten young) every four weeks. A typical rat **family** is about eight individuals, including adults and young. While rats in laboratories may live several years, most rats living around people survive on average only about six months. A typical urban rat produces an average of 20 surviving offspring during its short life.

Newborns—“pinkies”—are tiny, hairless, and helpless, dependent on their mothers, and may die of hypothermia if she is absent for long or if they get wet.

Rats live in **colonies** consisting of as many as 30 families, with established territories, demarcated by scents and pheromones, which they defend with lethal force against intruders. An aggressive male dominates each colony and may mate with dozens of females. Younger animals and less aggressive males may be forced out of the colony to attempt to establish new colonies, which leads to traveling animals that find their way to places previously uninhabited.

When there is plenty of food and shelter, rats in colonies may confine their foraging to a radius of only a few dozen yards. But all rats have an instinct for **exploration**, and if their quarters become too crowded or their food insufficient, individuals strike out on exploratory journeys.

Rats are **omnivorous** (eat both plant and animal material), and are scavenger, predator, and harvester of natural vegetation, all in one. Rats kill and eat birds and their eggs, small amphibians like frogs and salamanders, insects (including cockroaches), and each other, and they also consume seeds, berries, and other plant parts. They adapt quickly to eating grains, fish scraps, fruits, and other foods discarded or left accessible by people. Rats consume about 10 percent of their body weight in food each day. Peak foraging is at dusk and just before dawn, but they may be active around the clock and sometimes forage in broad daylight. Rats, unlike mice, require **free water** (1-2 oz) daily. The single surest determinant of rat location is a consistent food source.

The other determinant of colony location is **harborage** or shelter. Rats nest in burrows in the ground, in trees, rock piles, natural crevices, and so on. Around human habitations and infrastructure they burrow under sidewalks



and foundations and can inhabit virtually any part of a house or building, including sewer systems, basements, the spaces inside walls, stairwells, attics, and even furniture and desk drawers in working offices. They seek sources of heat and like to nest near furnaces and machinery. They are unfazed by loud noises or the presence of humans only feet or even inches away.

They can climb up exterior or interior walls of buildings, walk on ropes, cables and electrical wires, scramble up downspouts, and jump from one structure to another. They can squeeze through openings as small as a half inch and if there isn't an adequate hole they can gnaw through timbers or siding, and even metal in some cases.

Although roof rats are common in the contiguous United States and are known to inhabit ports that serve Alaska, such as Seattle, San Francisco, and Los Angeles, they do not survive as well in Alaska conditions as Norway rats. Therefore, this manual is intended primarily to address control and management of Norway rats.

### **Some handy rat facts**

- Average adult size of a Norway rat: 16 inches long (including tail) and 0.8-1.0 lb.
- Skull vertical height (and diameter of hole through which it can pass): 0.5 inch.
- Age at mating: 8-12 weeks.
- Gestation period: 18-22 days.
- Average number of pups per litter: 4-12.
- Age at weaning: 10-15 days.
- Life span: 0.5-1.0 years in wild rats, 3-4 years in captive rats.
- Breeding season: year-round if environmental conditions allow.
- Home range radius if adequate food is available: 100 feet.
- Distance rats have been documented to travel in one day: 4 miles.
- Rats can leap upward as much as two feet, and can jump horizontally four feet.
- Rats can swim a half mile, can remain afloat up to 72 hours if water is not too cold, can dive and can swim underwater up to 30 seconds.
- Estimated annual cost of rodent control in the U.S. (1990s data): \$337 million, including more than \$100 million for rats.

## THREATS POSED BY RATS

### Disease

Long associated with fearsome diseases like **bubonic plague** and **typhus**, rats are considered a serious threat to human health. In the last century some 100 million people worldwide are believed to have died of rat-borne diseases.

The history of rat-associated illness in North America is not as morbid as on some other continents. Evidence suggests that in the United States more people get sick from contact with mice than rats. *Hantavirus*, Lyme disease, rickettsial pox, and a serious flu-like malady caused by lymphocytic choriomeningitis virus (**LCMV**) are associated with exposure to wild or domestic mice. Furthermore, mouse urine causes many difficult-to-diagnose **allergies**, and there is a very high statistical correlation between exposure to mouse urine and **asthma**. (A mouse excretes 2,000-3,000 droplets of urine a day; it's their main form of social communication.)

That's not to say that rats are without human health issues. An estimated 14,000 people in the United States are **bitten** by rats each year, although most rat bites are not dangerous. Rats carry fleas, ticks, lice, and mites. Rats are associated with the spread of leptospirosis, salmonellosis, and other human diseases caused by bacteria, viruses, and parasites. Rats spread *E. coli* and probably are responsible for many cases of food poisoning. They elevate the level of bacteria in the human environment wherever they exist. In the United States, however, and especially in the northern latitudes, transmission of serious disease from rat to human is not well documented.

### Infrastructure

Rats are very hard on buildings, equipment, and property. They tunnel under sidewalks, causing **concrete to crack**. They gnaw on walls, door frames, foundation skirts, and other structural features. They shred insulation, furniture, bedding, and other materials to make nests. They gnaw on wires, sometimes causing **fires**. They gnaw through fuel hoses and gas lines, sometimes causing **explosions**. They destroy web in nets and pots stacked in port storage areas.

They eat any food they can get: grains and bulk agricultural products, pet foods, and human foods stored in boxes or containers to which rats can gain easy access by gnawing. They have been known to live in the insulated walls of cold storage facilities and eat meat in the freezer.



The 18 inch white stripe on the inside wall of this warehouse will reveal rodent rub marks if rats are present. The stripe on the floor should be kept cleaner to clearly show urine and droppings. Note bait stations along the wall (circled).

What they don't destroy they **foul** with feces, urine, and body oil or grease, which rubs off as they contact objects on their runs. Rat runways show as dark greasy streaks on walls. A typical rat drops 25-40 fecal pellets per day, each of which can contain hundreds of millions of viruses. Like mice, they have small bladders and urinate frequently, dispersing thousands of droplets per day.

## **Wildlife**

Of particular concern in Alaska is the damage rats do to wildlife. While they can kill other small rodents, invertebrates, and songbirds, the most serious problem is their effect on **nesting seabirds**. Most seabirds nest in burrows or crevices in rocks, or on open cliff faces, all of which are easily accessed by rats. Islands with established rat populations tend to have minimal seabird nesting, with ecological implications that extend beyond the birds, since seabird guano is the main fertilizer that supports island food webs.

Although the seabird nesting season is brief, rats kill and cache birds and their eggs. A single rat burrow in the Aleutians was found to contain 20 adult auklets.

About half of all bird and reptile extinctions recorded worldwide have been caused by rat predation.

# 3.

## Integrated Pest Management

Integrated Pest Management (IPM) also goes by other names, such as Integrated Pest Control and Ecological Pest Control. As the name implies, it relies on more than simply killing pests. IPM is sometimes called the “ecological approach to pest management.” It involves four strategies and intended outcomes:

- **Prevention.** Eliminating the potential for infestation through sanitation and exclusion of access to buildings and external harborage.
- **Inspection and monitoring.** Detecting the presence of pests before they can become established.
- **Record-keeping.** Documenting the need for control actions, and to provide bases for future analyses that will improve program outcome.
- **Reduced use of pesticides.** Pesticides are essential to the success of most IPM efforts but the amount of poison used can be minimized if it is applied most effectively.

A pest “exterminator” who poisons or traps rodents initially may kill a lot of rats, but that’s not an indication of long-term success. Rats will re-infest the site within months if the environment that supported them is not changed. The first response often is repeated baiting, but that is likely to be futile over time. Some animals never contact the baits or traps, and some become “trap-shy.”

While effectiveness is the motivation for IPM, the decreased emphasis on pesticides also reduces risks to people, pets, and nontarget wildlife. Furthermore, improved sanitation, which is the keystone of IPM, helps in controlling other pests such as mice, pigeons, starlings, and insects.

IPM is simple in concept but there is a lot involved with making an effective program. Good program management includes some or all the following components:

- Engineering criteria applied to infrastructure construction and renovation.

- Good pest control strategy and planning.
- Public relations to elicit cooperation of neighboring sites and the broader community.
- Contracts and specifications for property tenants and users.
- Effective and continued surveillance and monitoring.
- Site maintenance and sanitation.
- Good record-keeping to ensure performance and to guide adjustments in strategy.
- Periodic review and evaluation.

This manual attempts to apply the principles of IPM to the prevention and control of rats in waterfront facilities.

## **PREVENTION, CONTROL, ERADICATION**

“Prevention” is shorthand for prevention of the spread or establishment of rat colonies. This manual is intended to help facilities and vessel operators prevent rats from arriving on vessels and becoming established, from boarding vessels, and from reaching shores that currently do not have established rat populations.

“Control” is the purpose of most anti-rat programs. Entrenched rat populations are difficult or impossible to eradicate. The purpose of rat control in Alaska is to keep local populations low enough that few individuals are exploring the waterfront looking for new habitats, becoming candidates for boarding vessels. There’s a greater probability of at least one rat in a port population of a thousand finding its way onto a moored vessel than in a port population of one hundred. Controlling rats also reduces the possibility of property damage, disease transmission, and annoyed or frightened clients and the public. “Management” is another word for “control,” and “Integrated Pest Management” is defined as an “ecological approach to pest control.”

In other words, the principle of Integrated Pest Management is to **reduce the environmental carrying capacity** of the area to prevent rats from achieving breeding success supporting a significant population, and to prevent their dispersal.

“Eradication” means complete elimination of the animals from a geographic location. Although most of uninhabited mainland Alaska is thought to be hostile terrain for rats due to climate and ample presence of predators,

individual towns and ports can support isolated rat populations that could in theory be eradicated. In practice, rats widely established in municipalities and industrial areas are virtually impossible to eradicate.

Islands are another matter, and there have been many successful rat eradication programs on small islands around the world. This requires a massive poison baiting campaign, which poses some threat to native wildlife, but with great care it has been done. The U.S. Fish and Wildlife Service, Alaska Maritime National Wildlife Refuge, has developed plans for eradicating rats from certain islands in the Aleutian chain.

This manual addresses concepts and methodologies for prevention and control in Alaska ports, harbors, and other waterfront facilities, and aboard vessels.



# 4.

## Inspections

All Integrated Pest Management programs should begin with a detailed inspection of the area to find and identify rodent sign, possible sources of food, water and harborage, and points of access.

Inspections should provide information on the **severity** of the infestation and the **location** of harborage and high use areas, and should provide some indications of the **safest and most effective** control methods.

Because of the rat's secretive nature, it is often difficult to catch sight of one, and it's almost certain that if one is spotted, many more are nearby. If a close inspection turns up few fecal pellets, if only a single burrow can be located, and if signs of rat damage are few and confined to a small area, the infestation may be minor. When rat densities are low, simply keeping control pressure on the colony through a few strategically placed traps or bait stations, combined with rigorous sanitation and exclusion measures, may be enough to keep it in check and prevent its spread.

If sign is abundant and numerous runways and burrows are sighted, there is a heavier infestation and population pressures will force more individuals to travel in search of new habitat and opportunities. A more aggressive control effort is required, and the range of control methods should be expanded.

**Nighttime inspections** frequently are the most productive. Rats are nocturnal and often are easier to see at night. Furthermore, breaches of good sanitation practices sometimes occur in the evening and are apparent at night. Finally, with an appropriate "black light," it may be possible to see rodent sign that is invisible in daylight.

### GO EQUIPPED

It takes a trained eye to do an effective inspection. A **flashlight**, disposable **gloves**, **kneepads**, a hand **mirror**, a hand **lens**, and a field **notebook** are helpful in making a survey of buildings. The first three items make creeping around looking for sign easier, the mirror allows peering into tight spaces, the lens is for examining fecal pellets for short rodent hair which is a sure rat



identification, and the notebook is for sketches and notes about location of sign, use areas, and control methods.

Some professionals also carry a **black light** (hand-operated UV spotlight) for doing surveys at night or in dark spaces. Fresh rodent urine fluoresces (turns bluish white) in a black light beam; dried urine shows yellowish white. The inspector can determine the age of the sample, which helps indicate the frequency of use of the site.

If the inspection involves crawling around in confined, rat-infested spaces, **coveralls** should be included on the equipment list, as well as a HEPA (high efficiency particle air) filter **respirator**.

## WHAT TO LOOK FOR

An inspector looks for fecal pellets (droppings), urine stains, burrows, damage from gnawing, runways, tracks in dust or dirt, and grease marks (rubbings) on walls and beams. An inspection may turn up sounds (squeaks or scratches), rat odor, and live or dead animals.

Presence of feces, urine and grease—all rich in odors and pheromones—indicates that rats have used the location before and that they are likely to in the future, since the animals are attracted to olfactory cues left by others.



Norway rat droppings are  $\frac{1}{4}$  to  $\frac{1}{2}$  inch long, and capsule shaped.

It is more efficient and productive to think of the rats' requirements and search where those are found than to look randomly throughout the area. An inspection should identify primary feeding, harborage, and activity areas (the "rat zone").

## Feed

Look for accessible garbage, litter, food cargoes, fish processing waste, spilled or leaked edible substances, livestock or pet feed, dog and livestock feces, bird food, edible flotsam (dead fish, kelp, etc.), and natural foods including seeds,

nutritious leaves, small birds, and bird eggs. Rats like fresh and spoiled foods, can derive valuable nutrients from feces, and are quick to raid unattended dog dishes and bird feeders. They can catch live birds and can carry off fairly large eggs.

They cache food in their burrows for later use.

They can use bones and cleaned carcasses of chickens and turkeys. They like syrups, grease, sugar, and other remains left in discarded food containers and wrappers. A sure sign of rats is gnaw marks on packaging. They will gnaw right through heavy paper tubs and plastic barrels to get at food.

They must drink water each day. It can be from natural sources, or from condensation on refrigeration machinery, minor leaks, or standing water in drains.

## Harborage

When sources of food and water are located, they can serve as points to start the search for harborage. Rats typically nest near food sources. Look for active burrows, nests inside enclosures such as desk drawers, and nests in vegetation or other exterior structures. Ground-hugging vegetation provides lots of cover.

Look for spaces under building foundations, spaces in riprap or other stone or concrete piles, gaps under doors (or open doors) that allow access to inside spaces, air ducts, water lines, and unsealed windows.

## Burrows

Norway rats are burrowing animals and commonly dig tunnels to make underground nests. The typical rat burrow is 1.5 to 6 feet long, 18 inches deep, and has a main entrance hole 2-3 inches in diameter plus one or two “bolt holes” (emergency exits) that may be disguised with debris. Multiple burrows may interconnect to form an underground network. Nests are insulated with natural vegetation or with manmade materials like paper, furniture stuffing, building insulation, and string. Burrow entrances usually are at least partially concealed by vegetation or by their position under sidewalks, roads, building foundations, riprap, or natural rock.

Locations of burrows may be indicated by debris excavated by the rats during nest-cleaning, by droppings, and by trails or runways leading to the burrow entrance. After a light snow, runways may show up clearly. Check piles of debris, equipment, and fishing gear that could conceal rat burrows or nests.



**A glue tray can be used to detect rat runways.**  
Courtesy Woodstream Corp.

## **Travel routes and other high-activity areas**

Rat zones tend to be between the nest and the food sources. Rats like linear spaces, particularly if they offer some concealment. Check for droppings and rub marks along the floor at the bottom of walls, in gutters, on ledges, between walls and units of equipment like coolers and stoves, in sewers or drainage pipes, on ladders and railings, on pipes and wires. Look for runways (trails) in grass and native vegetation (often straight lines between heavy cover and a food source).

Glue boards or glue trays, while ineffective at controlling rats, can be useful for determining whether runways are being used by catching rat hair, droppings, and footprints. Another way to determine if rats are using a runway is to spread a thin layer of flour or talcum powder and later check for tracks.

The density of clues like feces and rub marks indicate the frequency of use and the probable density of the local population. Heavily used areas should be noted and described in the field notebook so they can be targeted for intensive control measures.



Rat trails in a city park show clearly with a light dusting of snow. The main trail connects the burrow (left center in the open white area) with a trash receptacle outside the picture to the lower right.



# 5.

## Sanitation Is Pest Control

Sanitation means elimination of available foods as well as cleanliness, absence of debris and clutter, and general tidiness. Sanitation is the best approach for suppressing the reproductive capacity of rats to its lowest possible level.

Rats can survive on wild foods. In Alaska they can thrive where other predators are lacking and concentrations of potential prey exist, such as in seabird rookeries on islands. In general, however, human habitations and food provide habitats capable of supporting much larger populations of rats than natural habitats. Eliminating food sources severely limits the rat carrying capacity of a location. Consider three kinds of nonnatural food sources:

- Garbage intentionally discarded but not effectively contained before disposal.
- Food litter—dropped or spilled food, food scraps, remnant sauces, etc.
- Food cargoes and scraps or byproducts from processing.

Urban areas have major problems controlling garbage and food fragments. Various designs of containers, garbage cans, and dumpsters are more or less effective at containing garbage and excluding rats. Street and grounds cleaning, frequency of trash and garbage pickup and public information/public relations (including signage) all are factors in the control of garbage and food fragments as rat food.

At ports where **edible cargoes** (grains, fruits and vegetables, animal feeds, bulk juices or syrups, etc.) are transferred, special effort is required to prevent and clean up spills, and keep sites clear of small residues of edible substances that may fall out of containers or otherwise reach the ground or rat-accessible spaces.

**Seafood processing** presents special challenges. Fish processing waste is highly nutritious rat food. Product staging areas, processing lines, cold storage and freezers, and effluent outfalls (if sufficiently close to shore) are all sources of food to rats. Fish plants and their grounds must be kept scrupulously clean. Alaska Department of Environmental Conservation (ADEC) Food Safety and Sanitation regulations 18 AAC 34 should be considered just starting points at which plant operators begin their efforts to deny food to rats (See sidebar Rat Control in Seafood Plants).

## **RAT CONTROL IN SEAFOOD PLANTS**

Many Alaska ports have seafood processing plants in or adjacent to their harbors. These plants can be very attractive to rats because they are potential sources of food. Rodent infestation is one of the most serious breaches of food processing plant standards and can result in fines or closure of an operation.

Food processing plant sanitation is governed by state law, which is administered by the Department of Environmental Conservation. Facility requirements are contained in 18AAC 34.060, which states, in part, that the walls and roof “must protect the FACILITY from weather and the entry of insects, rodents, and other animals.”

Each processing company or facility should have its own rodent control plan, based on the concepts expressed in Hazard Analysis Critical Control Point (see Chapter 13). Following is an example of a fish plant list of essential pest control points, courtesy of Ocean Beauty Seafoods, Inc.

- Eliminate areas of potential harborage from the exterior of the facility, including weed growth, standing water, and refuse.
- Assure all exterior doors are closed except when forklifts are transferring product.
- Maintain building interior and exterior to prevent bird roosting and harborage of small mammals.
- Keep building and dock clear.
- Seal all holes in walls and floors to prevent pest entry or harborage.
- Allow 18 inch clearance between interior walls and stored items
- Immediately remove any spilled food products.
- Visually inspect all incoming supplies for signs of infestation or contamination.
- Conduct inspections for signs of pests daily as part of the plant's Sanitation Standard Operating Procedures.

### **More fish plant suggestions**

Maintain a clean white-painted strip 18 inches high and 18 inches wide around the interior of the building where the walls meet the floor. This indicator strip will clearly reveal the presence of any rodent feces, urine, or grease marks should the animals get established inside the building. Keep the strip and areas next to walls clear of supplies and equipment to facilitate inspection.

Maintain a perimeter defense of bait/trap boxes around the outside of buildings.

If possible, deploy only mechanical traps inside the facility. Toxic baits in food processing facilities are strictly regulated. If pesticides are ever required, check with ADEC for authorization and guidelines.

Apply high standards of sanitation to garbage and fish offal handling and transport. Do not allow any fish guts to lie on the ground or in uncovered containers—including dumpsters—that are accessible to rats, or to birds that may drop them where rats can reach them.

Use a checklist for staff to follow in conducting daily inspections, and keep records of performance as well as any findings such as live or dead rodents.

Stored **fishing gear**, including bait and fish or particles of fish left in nets and traps are also rat food. Fishermen should be made aware of the importance of cleaning their gear prior to storage rather than waiting until it is needed again.

Operators of **restaurants** and other **food service facilities** on or adjacent to waterfront property must be especially vigilant in handling of garbage and food wastes. Rodent-proof building design is important, and rodent-proof garbage containers must be used. Grounds surrounding food outlets need frequent and thorough inspection and cleaning.

Improved sanitation in waterfront facilities has **behavioral** and **structural** components.

Facilities operators, employees, and crews first have to **understand** the problem, **know how** to eliminate food sources, and then decide to **take action**. This may require use of informational handouts and posters, lectures, instructions from supervisors, and even penalties for noncompliance.

Secondly, port and harbor grounds and facilities, including processing plant sites, must be structured to as nearly as possible deny rats access to food sources. For example:

- Ensure trash receptacles and dumpsters are conveniently located near use areas, are designed to be impregnable to rodents, and are kept properly closed to prevent access. Birds like crows and seagulls can pitch garbage from dumpsters onto the ground.



- Buildings where food products are stored or processed must be designed and maintained to exclude rodents. Doors need rodent-excluding weather strips and must be kept closed, windows and vents need screening, and so on. Spaces in floors, walls, drains, and other potential access points to food sources need to be plugged.
- Fish cleaning stations at boat harbors should be designed so that no fish scraps are accessible to either rodents or birds. This also helps with the human health and sanitation issues associated with seagulls, eagles, and other scavengers at fish cleaning points. Cleaning stations should be easy to clean and should drain into sewers or other containers that prevent access by rats.

Some of these structure and infrastructure problems are expensive to implement and require major modifications to the facility. The best prevention occurs at the design phase, but facilities operators and their staffs should be able to make inexpensive but effective improvements.

# 6.

## Rodent-Proofing Waterfront Properties: Interdiction and Exclusion

To quote Dr. Robert Corrigan, a leading authority in rodent control, “In the true intent of IPM, rodent-proofing programs, when combined with effective and ongoing environmental sanitation programs, provide the most cost-effective and long-term infestation control.”

Several terms are used more-or-less interchangeably: **prevention**, **exclusion**, **quarantine**, and **rodent-proofing**. With some subtle distinctions, these all refer to preventing rats from entering and becoming established in a specific structure or space. **Interdiction** refers to stopping them along their route of travel on the way to a structure or space.

### PLANNING

Integrated Pest Management is conducted somewhat like a military operation. Rats are an invading force. Inspections are reconnaissance and intelligence-gathering. Depriving rats of food is like disrupting enemy supply lines. Extermination correlates to search and destroy. Interdiction and exclusion (rodent-proofing) are like establishing and maintaining defensible perimeters. The planning for this phase of the campaign starts with an analysis of the site to determine where the rats are most likely to breach the perimeters.

On waterfront properties this defensive posture has two components:

1. Preventing rats from entering the property or, once in, from traveling freely across the property in search of food and harborage.
2. Preventing rats from gaining access to buildings, storage areas, and other suitable locations for nesting and concealment.

Rats love **straight lines**. Streets, alleys, sidewalks, curbs and gutters, railroad tracks, sewer lines, utility lines, fences, and dock bullrails all provide linear travel routes. Most also provide some measure of cover, so they serve as rat roadways.

Since rat movement is governed in part by **thigmotaxis** (orientation based on tactile stimuli), they like tight channels, tubes, cracks, and other linear features that allow them not only concealment but also the ability to feel the features with their bodies as they travel. The narrowest of spaces in which to travel are the most appealing.

Property managers should get to know the linear components of their sites, and should look for the likely access points to those components. A detailed **site plan** clearly illustrates the rat access points and the linear travel routes.

The greater the distances between elements of cover along the travel routes, the less appealing to rats. Alaska ports tend to have **predators** like eagles, weasels, and foxes, so rats take a big risk if they try to cross open terrain.

## DENYING HARBORAGE

Digging a burrow is labor-intensive and hazardous, and rats are happy to occupy available spaces provided by humans. Norway rats usually pick nesting sites at or close to ground level, but they can nest above ground as well. Roof rats favor locations in roofs, attics, trees, and other overhead locations.

Rats like **interstices** (voids between inner and outer walls), foundations, porches, storerooms, and attics of buildings, as well as furnace and machinery rooms that **provide warmth**. Excluding rats from these spaces deprives them of harborage, protects the building from rat damage, and keeps them away from food sources and contact with people's living and working areas.

Sheds, gear storage areas, piles of rock or concrete left behind after construction, stored or discarded building materials, and even unused vehicles can harbor rat nests. Rats nest as well as feed in stored **fishing gear** including nets, coiled groundline, and traps (pots).

Rats seek cover for all their activities, including feeding and exploring. Any stationary object big enough to conceal a rat provides harborage. Vending machines, refuse, stored equipment, cargo pallets and containers—virtually everything found at the site of a port, harbor, or fish processing plant—provides cover for rat activity. Ornamental vegetation and overgrown natural vegetation provide excellent harborage. Even objects temporarily in place such as parked cars provide cover for traveling and feeding.

While most of the items on a waterfront facility's grounds are there for a reason, a certain amount of **unnecessary clutter** may gather. Simply cleaning up the grounds, removing vegetation that abuts buildings, and removing materials not being used will deny rats some of their harborage.



These stacked pallets provide great harborage and concealment for traveling rats tracking along the side of the building.

Storage areas need to be clearly defined and marked, and kept tidy. Stored or unused equipment and gear often gets pushed to the sides to make room for forklift traffic, and this accumulation around the edges makes great rat harborage. They favor **edge environments**, including fence lines, walls, and bulkheads.

Clients of the facility should be informed of the rat issues associated with the items they store on site and should be encouraged (or compelled) to manage their property to minimize benefits to rats.

## INTERDICTION

A “pathways analysis” will provide indication of routes that traveling rats are likely to take. Lines of travel may be blocked by rodent-proof **fencing** or other barriers. The ideal fencing includes an overhang barrier at the top to prevent rats from climbing over, and a buried mesh skirt at the bottom to prevent tunneling under.

Some access points can be blocked by use of a sheet metal patch, for example, or by filling cracks in concrete with cement or mortar.

A site plan also suggests suitable locations for **defense stations** that contain poison baits or traps (see following chapters). Baits and traps should be directly in the line of rat travel. Rats usually enter the bait stations for shelter or concealment, and then decide to sample the bait that they find there. Snap traps are only effective if set directly on (unbaited), or immediately next to (baited), rat runways.

Interdiction, therefore, can encompass physical barriers, disruption of concealing lines of travel, and placement of bait stations or traps on travel routes.

## **STOPPING RATS ARRIVING BY SHIP**

Ideally operators of ports of origin do not allow rats to board or leave vessels using their facilities. However, such expectation is unrealistic and facilities operators must take steps to prevent invasion by shipborne rats. A few methodologies apply:

- **Rat guards on mooring lines.** These are sheet metal collars or cones that prevent rats from climbing up or down mooring lines. They are effective to the degree that they are properly installed and maintained; frequently they are observed to be neither. Even if all mooring lines have effective rat guards, there are often water, fuel, and utility lines strung between ship and shore on which rats can travel. Rat guards should be placed on all lines linking vessel to dock.
- **Illumination of docking area.** Rats move about at night and prefer to remain concealed, so bright lighting discourages their travel. Especially useful is to light up gangways and other means of transfer between ship and dock.
- **Bait stations placed around loading areas.** They should be maintained on likely travel routes of any rats that may jump ship, from the vessel to harborage and food locations.

Small vessels, while possibly less of a rat-carrying threat, pose a more difficult problem because their decks are lower and close to the dock or float, and because they moor close enough that rats can jump off. Rat guards may be useless, but illumination and bait stations can still be effective in stopping new arrivals.



Sheet metal collars called rat guards prevent rats from using tie-up lines and other service hoses and cables to get on or off of ships. However, note that two of the four in the picture are unprotected.



Bait stations placed around loading areas are maintained on travel routes.

### **VESSEL OPERATOR TIPS**

Rats are bad news on boats and ships. They destroy gear and furnishings, contaminate food, and damage operating systems by gnawing the wiring, hoses, and pipes. They can cause electrical fires by gnawing wires. They contaminate cargoes.

Furthermore, rats “hitchhiking” on vessels may spread to previously un-infested areas including remote islands where they can destroy seabird colonies.

Vessel operators must take steps to ensure that rats do not get on board, and to eliminate any that do. (See the Alaska state regulation on harboring and transporting rats, in Introduction.)

### **Preventing rats from boarding ships**

- Develop a written IPM plan that outlines crew responses and responsibilities, establishes health and safety procedures, addresses effective monitoring and control strategies, and includes requirements for logging pest sightings and pesticide use.
- Practice good sanitation. Keep food and garbage contained and protected. Minimize odors from food, garbage, bait, and fish gurry. Rats are more likely to be attracted to a smelly boat than one that is clean and lacking food odors.
- Keep ship’s stores and edible cargoes in rodent-proof containers or buildings if they must be held before loading.
- If ramps or gangways are used they should be well lighted at night to discourage rats, which are nocturnal.
- Gangways and other means of access should be separated from the shore by 6 feet when not in active use, unless guarded to prevent rodent movement. Raise or remove cargo nets when they are not in use.
- Deploy rat guards on tie-up lines and service hoses and wires. Navy standards call for discs at least 36 inches in diameter, with a cone angle of 30 degrees, placed at least 6 feet from the closest point on shore and at least 2 feet from the ship. Cones should point toward the ship. Use tightly secured rags to plug gaps. Place guards on all lines connecting the vessel to shore, and ensure that the guards are connected correctly.
- Seal entry points to the boat’s interior, such as cable chases and louvered vents. Keep doors and hatches closed while in port.
- Inspect cargo and supplies for rat sign, preferably before loading.
- Deploy traps and sticky boards (see below) as a preventive measure.

### **Keeping rats off small boats**

- Become informed on rat prevention problems and methods.
- Practice good sanitation. Keep food and garbage contained and protected. Minimize odors from food, garbage, bait, and fish gurry. Rats are more likely to be attracted to a smelly boat than one that is clean and lacking food odors.
- Ensure that the crew recognize rat sign, and immediately report if any is spotted.
- When tying up in port, look for ways that a rat could board the boat, and take preventive measures. Rats can easily board boats tied directly to float or bulkhead. If space allows, deploy traps on deck or next to the boat while in port.
- Small boats can use rat guards fashioned from plastic bottles.
- Seal entry points to the boat's interior, such as cable chases and louvered vents.
- Inspect and shake out fishing nets, pots, and lines before taking them aboard. Rats hide and nest in stored gear. Most gear storage facilities do not have rat control programs.
- Inspect cargo and supplies for rat sign, preferably before loading.
- Keep doors and hatches closed while in port.

### **Kill any rats found on board**

- Use multiple approaches, including traps and sticky boards.
- Poison baits are a last resort, as rats may die in inaccessible spaces and cause a stench lasting days.
- Place traps in dark and concealed spaces, near food, and in warm (but not hot) parts of the vessel. Set so that the trigger end is toward the bulkhead. Secure traps in place.
- Use fresh bait in traps, and be patient. Rats often will avoid a baited trap for days.
- Use baited, uncocked traps for a few days to overcome the rats' neophobia.
- Secure bait to trap trigger with cheesecloth or gauze so rats can't steal the bait.
- Once traps are set, leave them in the same place. Moving them around may increase rats' wariness.
- Rats on board may be deprived of fresh water. Use juicy baits like tomatoes or fruit.



- If you catch one rat, don't assume it's the only one on board. Redeploy traps.
- Never throw a live rat overboard; they are good swimmers.
- If you frequent infested ports, consider having trap stations built into the vessel.
- If you find rats aboard, notify the harbormaster of the port where you think they boarded.

Under international health regulations, ships entering foreign ports may be required to trap or fumigate for rats if they are found aboard. See the U.S. Dept of Health and Human Services document known as Derat Form.

**Get a free on-board rat prevention kit from the Alaska Maritime National Wildlife Refuge. See [www.stoprats.org](http://www.stoprats.org).**

## **RODENT-PROOFING BUILDINGS**

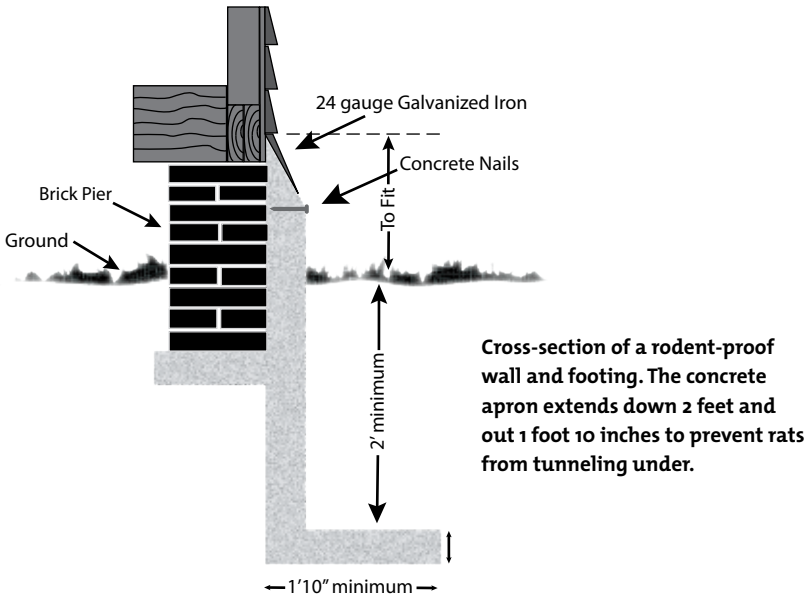
Rat-proofing a building is largely common sense, but it takes a critical eye to identify all the potential entry points. Adult rats can pass through any opening as big as a quarter, and juveniles a hole as small as a dime. Block any hole that size or larger.

Rats are great climbers; they can use tree limbs, trellises, downspouts, electrical and telephone wires, and parked equipment and machinery to gain access to upper levels of buildings, where they can live in attics and above ceiling panels. They can climb up the exterior of a building and enter through open windows. Roof rats are even better climbers than Norway rats and spend most of their lives in overhead spaces.

A key to rodent-proofing a building is to **clear a space** around it of limbs and branches, debris, stored items, etc. A horizontal distance of at least four feet should be kept clear to prevent rats from jumping onto upper levels from elevated locations.

The common Norway rat usually prefers low-level living. It's logical to begin rat-proofing at, or even below, ground level. Make sure rats **aren't able to tunnel** under walls or foundations. Use a "curtain wall" of concrete or brick to prevent tunneling. Or dig an 8 inch deep, 12 inch wide **trench** around the building and fill with pea gravel; rats don't like digging in loose gravel.

Block any cracks, structural defects, or damaged points in foundation walls or skirting. Portland cement mortar, concrete, masonry grout, or commercial concrete patch materials are suitable. Temporary fixes can be made by stuffing



cracks with bronze wool, copper mesh, hardware cloth, or galvanized screen.

Check all utility lines entering buildings above, at, and below ground, including plumbing, sewer lines, heating ducts, electrical conduits, and drains, for any access points. Large gaps can be plugged as above. Smaller spaces can be closed with sealants. Vents, window casements, and basement entrances should be checked and likewise blocked or sealed.

Most rodents that get into buildings go **through open doors** or **beneath doors** that aren't properly sealed or are damaged at the bottom or sides. Receiving bay doors should have automatic door closers. Facility operators should post notices directing staff and clients to keep doors closed.

Doors should be pest-proofed with rubber or vinyl **sweeps**, with door brushes, or with metal **compression stripping**. Since rats can gnaw through wooden doors, 12 inch metal kick plates may have to be attached to the bottom exterior of wooden doors. Metal thresholds may be required to match door bottom guards.

Cracks and spaces in interior floors and walls of warehouses, storage sheds, processing buildings, and such should be patched or blocked in the same manner as the exterior.

Use only metal screens on windows accessible to rats.

Close off spaces under equipment like reefers and freezers.



Metal flashing, grout, or cement can be used to plug openings around pipes entering the sides of buildings, to prevent rat access.

Drains and vents should be blocked by grates, screens, or louvers with appropriately sized openings.

Ribbed or corrugated siding may allow entry if it's not in contact with a solid surface for the entire length of the wall. Use sealant to fill the spaces.

Galvanized sheet metal collars or **rat guards**, similar in concept to those used on ship mooring lines, can be installed on downspouts and other exterior pipes.

Block any openings in roof joints, eaves, and fascia boards, or where roofing may be loose. This excludes rats as well as squirrels, bats, and birds.



Bay doors should be kept closed when not in use, and should fit snugly to deny rats access to the building. Note the bait stations that interrupt the straight travel routes on the building side; there should also be bait stations next to the bullrail on the water side.

# 7.

## Rat Traps

Good sanitation and physical exclusion can prevent rats from getting a foothold, and can keep their numbers in check if already established. But if conditions allow, the animals will breed rapidly and it often becomes necessary to kill rats to prevent their increase and spread. This is particularly true where managers and operators are unable or unwilling to maintain adequate sanitation and exclusion.

People kill rats several ways. This chapter deals with mechanical traps, and the following chapter addresses rodenticides.

### SNAP TRAPS

Rat traps are basically large versions of the mouse trap. They have a wood, metal, or plastic base. Some “easy set” and “quick-set” models can be set with one hand by squeezing, or by stepping on a part of the trap. The Ka Mate from New Zealand is made of aluminum and stainless steel, and has a trigger design that requires that the bait be pulled to trip. Early testing suggests that the Ka Mate is less prone to accidental tripping from bouncing and bumping, and may be more suitable for use in moving vehicles and vessels, although it wouldn't be effective if used as an unbaited trap.

Compared to other control devices snap traps are inexpensive, easy to deploy, reusable, and acceptable where poison may be prohibited. They allow recovery of dead animals to prevent odors and to confirm kills. (Carcasses can be useful in illustrating the threat of rat invasion.) Most models usually kill instantly. But they require skillful placement to be effective, are more labor-intensive than rodenticides, and they must be checked and emptied frequently. Furthermore, the close contact with rodents increases the potential for disease transmission to the people tending them.

Snap traps can be installed in **stations** consisting of specially designed plastic, cardboard, metal, or wooden boxes similar to those used to contain poison bait. There are several advantages to trap stations: they protect hands and feet and pet noses from injury, they prevent accidental springing, they

conceal the traps and dead rats from public view, and they make it easier to place set traps (with use of a pole or tube) in hard-to-reach locations, among others.

There is some risk of catching **nontarget species** in snap traps. Small songbirds are sometimes killed in trap stations, as are native rodents such as lemmings. This can be prevented by placing short pieces of PVC pipe in the station openings, extending outward. Arctic foxes may be injured by putting a paw into a trap station; this can be prevented by putting baffles in the station.



This is an example of a quick-set trap that can be armed by squeezing with one hand or by stepping on a flange at the rear. Courtesy Woodstream Corp.



This wooden base trap has an expanded trigger and can be used baited or unbaited. Courtesy Woodstream Corp.

## **DEFENSIVE TRAP STATIONS FOR ALASKA CONDITIONS**

Commercially manufactured bait/trap stations may be suitable for use at many Alaska waterfront facilities, but in some cases they may need added protecting to deal with weather and the harbor environment. Accumulated or drifted **snow** or **sand** may bury or fill them in, high **winds** may carry them off, **vandals** may open or break them, and harbor equipment such as forklifts may **smash**, **run them over**, or **push** them into the water.

Since 1993 a partnership between the Alaska Maritime National Wildlife Refuge (AMNWR) and the local governments of St. Paul and St. George has maintained a successful rat prevention program in the Pribilof Islands, and has developed defensive stations suited to the harsh environment. After experimenting with various designs, the Pribilof program to date has settled on three primary designs, as described below from notes provided by Art Sowls, AMNWR.

## Plywood cubes

A four-foot-square box is built of ½ inch treated plywood over a frame made of two-by-fours on top of a cargo pallet. Holes of about 2 inch diameter in the bottom of the box allow rats entry. Inside are bait stations and snap traps. Old fishing buoys are placed inside the cube to provide flotation in case the cube is pushed into the water. Potential nesting material is placed inside to make the cube more appealing to rodents.

The cubes are used in some locations because they are more visible to equipment operators and can be placed in locations where there aren't enough attachment points for securing lighter boxes. They can be moved by forklift to respond to changing needs. Students build them as class projects, which raises awareness of the rat control issue and gives the community ownership in the project. Students decorate them with posters or appropriate artwork.

## Plywood boxes

Locally built boxes of treated plywood, measuring 24 inches by 12 inches by 6 inches have been the main bait/trap station used in the Pribilofs. Sides are made of ¾ inch plywood, and the top and bottom are ½ inch or ¾ inch. Two-inch entry holes are in each end. Box dimensions can vary, and they can



A cube station, such as this one in use at St. Paul, is visible to equipment operators. It can be moved around on a pallet, and provides an opportunity to convey outreach messages through local art. Art Sowls, USFWS.

be made irregular in shape, so that they fit in specific protected or hidden locations, such as under bullrails, behind fixed machinery, etc. Inside is a raised platform with a bait station and snap trap; baffles are positioned so that rodents can get around them but they help keep out blowing snow and the paws of curious foxes.

Tops are secured with Phillips head screws that are put in place and removed with a cordless drill. Earlier designs with hinged lids secured by padlocks suffered from corroded locks and damage by vandals who apparently thought the locks indicated that valuables were inside.

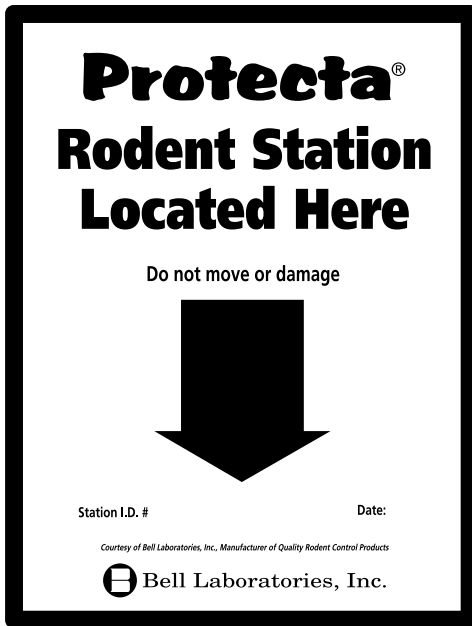
## **BARRELS**

These stations are made of 30 or 50 gallon plastic barrels, and were designed to overcome the problem of snow or sand covering or clogging other kinds of stations. Plastic replaced steel barrels that rusted away too quickly. Inside the barrel, at the top, is a plywood platform with a bait station and trap. Four 2 inch diameter entry holes are drilled in a column up the side, starting just above ground level. This allows continued rodent access to the inside even if snow covers the lower holes. The barrels are partly filled with rocks to add weight and to provide a surface for the rodent to climb to reach the bait and trap.

Removable cam-lock bands hold the lids on and allow for easy tending of traps and baits. The barrels are brightly colored and clearly marked as rat defensive stations.



**Barrel rat stations such as this one are used in the prevention program in the Pribilof Islands. The barrels protect bait and traps from the weather. Art Sows, USFWS.**



Locator sign to identify location of a trap station or bait station.

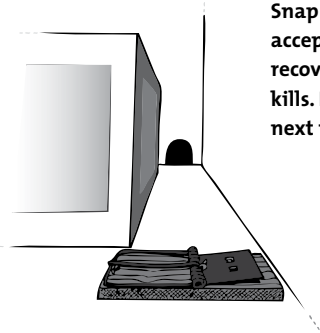
### DEFENSIVE STATION TIPS

Defensive (bait/trap) stations are designed and positioned to offer shelter and food to arriving or traveling rodents. Placed on likely travel routes, they appear first to provide a dark and secure place to hide. Once inside, rodents can smell the bait and thus are drawn to the traps and rodenticides.

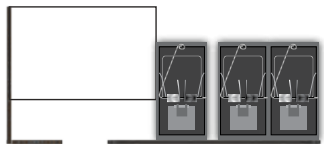
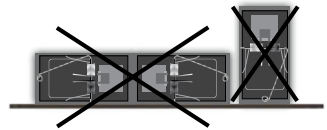
- Traps may be unbaited large trigger types or conventional traps with durable bait, such as peanut butter. The bait can be tightly wrapped in plastic film to protect it from molding and drying out.
- Stations in open areas are bigger and have multiple entrances. Stations placed against buildings or docks are long and narrow for better fit.
- Stations are labeled with signs indicating their purpose and warn of poison baits.
- Tamper-proof metal bait boxes are used inside the stations to further secure the baits. The locking screw is treated with an anti-seize compound to prevent corrosion.



- A cordless drill and Phillips or square slot head screws allow for quick and easy maintenance while discouraging tampering.
- Raising stations, traps, and bait boxes, and adding baffles, reduces the problems of flooding, blowing snow, and sand.
- Requiring workers to turn in plastic “verification cards” randomly placed in some stations ensures compliance with schedules for checking all stations.
- Indicator stations without rodenticide baits can be placed outside the defense area for monitoring.
- Rodenticide with Bitrex can be used to lessen the danger to people if that appears to be a problem.



Snap traps are inexpensive, easy to deploy, reusable, and acceptable where poison may be prohibited. They allow recovery of dead animals to prevent odors and to confirm kills. Place the trap in the runway with the trigger end next to the wall.



When using two or more traps, place them in the runway perpendicular to the wall with the trigger end next to the wall; OR back-to-back, parallel to the wall, with the triggers at opposite ends. Rats traveling in either direction will encounter the triggers.



## BAITED OR UNBAITED TRAPS

Traps are available on the market with extra large trigger pans, which allow the trap to **work without bait**. This is called a “runway trap”; a traveling rat will step on the trigger before its vibrissae warn it of a foreign object.

Unbaited traps should be placed perpendicular to the wall with the trigger facing the wall. Rats often jump over unfamiliar objects in their territory, so effectiveness can be improved by placing two traps “back-to-back” parallel to the wall with the two triggers facing out. Another approach is three traps in a row, triggers facing the wall, since that’s a long jump for a rat in a confined area. The “sandwich technique” involves three baited traps in a row facing the wall, the outer two not set.

A wide **range of baits** can be used on baited traps. When dealing with an infestation, good practice is to use several different baits when setting multiple traps. Popular baits include peanut butter, bits of meat, small candies, cheese, fruit, and vanilla extract. It may pay off to bait traps with foods different from what is locally available. The alternative is to bait with what the rats are already known to feast on at that location.

Sometimes nonfood items are used for bait, such as dental floss. Nesting rats collect string and insulation materials.

Rats are **neophobic** (afraid of new objects in their environment) so they tend to avoid traps for several days before finally succumbing. Experienced rat trappers sometimes put out baited but uncocked traps for a few days to get the animals used to their presence before deploying cocked traps.

Rats that have been injured by a trap but escaped are called “experienced” or “trap-smart” and are believed to teach trap avoidance to their offspring.

## TRAPPING STRATEGIES

- Trap placement is critical, and should be based on rat high-use areas identified through a careful inspection. Even distribution of traps throughout a building or facility is not nearly as effective as concentrating them in high-use areas.
- The best locations are in concealed areas (out of reach of people’s hands and feet as well as pets) that are travel corridors between rat feeding areas and harborage. Along walls, behind furniture, and near holes are good locations.

- Use plenty of traps. Placement can be as close as every six feet on well-used runs.
- Unbaited traps should be placed directly on a run; baited traps should be set back 8-12 inches from the surface of the run.
- Whatever the bait, attach it as securely as possible to the trigger so that the rat can't lick it off without triggering the trap.
- It may be necessary to "pre-bait" by deploying baited but uncocked traps so that rats overcome their fear of new objects and learn to take the bait.
- Tasty substances like cereal can be sprinkled around traps to make them more appealing to rats.
- Traps can be disguised by covering them lightly with dirt or sawdust, or sinking them slightly into the ground. The trigger may have to be protected by a light piece of cloth.
- Snap traps don't last long in wet or damp locations because the mechanisms rust.
- Old traps should be scraped and kept clean.
- Check traps daily, remove dead animals, and reset traps.
- Secure traps in place so that animals caught by a foot or tail can't drag traps away.
- Wear disposable gloves when handling traps and removing dead animals. Avoid touching carcasses, feces, and contaminated substances, and avoid breathing dust in the vicinity.
- Keep detailed records of trap locations, baits used, trap success and observations, including fecal pellets, gnawed bait, and other indications of rat presence. These records will help you to find and recover traps, prevent injuries, and devise effective baiting and deployment strategies.

## **RAT CONTROL ALTERNATIVES**

Many approaches have been tried to kill or repel rodents. While each has its adherents, vertebrate pest control scientists and professionals say that **none is likely to be effective at controlling a rat infestation**. In certain circumstances, however, a facilities operator may consider any of the following.

Natural **predators** such as foxes and coyotes catch rats, but they are not considered effective control agents in built-up areas. Cats and certain breeds of dogs can catch sick or weak individual rats and are sometimes credited with keeping localized rat populations in check, but they too are ineffective against entrenched colonies. Ferrets are used to flush rats from their burrows but like all of the above, they have limited capabilities.

Commercially available **electric shock traps** are made in sizes suitable for rats, and are considered moderately effective. They use high-voltage, low-amperage current powered by batteries. They are expensive compared to other traps, they don't necessarily kill instantly, and some people consider them inhumane. They cannot be used where children, pets, or nontarget wildlife might find them.

**Glue boards and glue trays** are good for catching mice. They are less effective on rats, although young rats may fall victim to glue. Adult rats have a better chance of escaping glue than mice due to the rat's greater size and strength. A rat has to "fully commit" to a glue trap; that is, it must come down firmly with at least a couple of feet. Some people put barriers, such as bricks, on both ends of the glue trap, which forces the animal to leap and land on the trap. Trapped animals found still alive must be killed, usually by crushing or drowning. Some die from stress, heat exhaustion, or thirst, or are attacked by other rats. If glue boards are used, they should be firmly attached to the floor so that stuck animals don't drag them away. Glue boards and trays can be useful for determining whether runways are being used.

Various kinds of **repellents** are on the market for keeping rodents out of specific locations. One is a mixture of sulfur and naphthalene (moth flakes). No evidence of effectiveness in the field is available. Ropel, containing denatonium saccharide, is used to treat garbage cans and other items, and seems to be effective in reducing rodent attack. Denatonium saccharide, which has a bitter taste, can be transferred to the hands of the applicator, but the Environmental Protection Agency considers it a nontoxic inert ingredient.

Some users report success with fox urine, but as an unregistered pesticide it is not legal. Only registered pesticides and repellents should be used to ensure safety and efficacy. Home remedies should not be used, especially around food handling, medical facilities, schools, and daycare units.

Various **electromagnetic** and **ultrasonic** devices are sold for repelling or controlling rats. Anecdotal reports indicate some success, although laboratory research results indicate they are ineffective. Ultrasonic devices are designed for relatively small spaces (up to a few thousand square feet) and are not intended to prevent rat infestations in large structures or on open grounds.

Rodetrol is a nontoxic bait product made of ground corn that is considered a “**satient**” and is claimed to cause rats to feel full so they stop eating and eventually starve. There is no evidence that these corn starch baits have any efficacy to rodents in test situations, and it is reported that the Environmental Protection Agency has revoked its registration.



Glue boards such as the one in this station are usually not considered effective at controlling established rat populations. They will catch young rats and they can be useful indicators of rat traffic if set on rat runways.

# 8.

## Rodenticides

Usually the most effective method of killing rats is judicious application of one or more of the common rodenticides. This is known as “chemical control.”

**The use of “rat poison” is controversial, for a couple of reasons. The wrong rodenticide, or the right rodenticide applied incorrectly, could be fatal to children, pets, and wildlife.**

Poisons used in the past, like strychnine, are believed to have caused their victims suffering prior to death. Most rodenticides that attack the nervous system have been abandoned by the pest control industry or have been banned and removed from the market.

The currently popular toxicants, commonly referred to as “second generation anticoagulants,” kill by disrupting the blood’s ability to coagulate, while damaging internal capillaries, causing hemorrhaging.

**Results of laboratory research suggest that animals that have eaten toxicant baits continue their normal daily activities, don’t experience pain or stress, and expire quietly over a period of several days from anemia resulting from gradual loss of blood.**

Modern rodenticides come in several forms, each for a specific purpose. Most common are blocks (for use in bait stations), pellets or meal (for placing in burrows or tamper-proof bait stations), liquid or water baits, and tracking powder. There are also fumigation-type rodenticides. Fumigation requires special training, equipment, and pesticide applicator certification.

*Note: Under federal and state law, persons who apply restricted-use pesticides (RUPs), apply pesticides in most “public places” or commercial settings, including the rodenticides discussed below, must be state certified as a pesticide applicator. See sidebar on Alaska pesticide applicator certification. Pesticide permits may be required from the Alaska Department of Environmental Conservation for application on state lands. Application records may also be required. For more information on registered pesticides, permits, and certification, see the ADEC Web site at [www.dec.state.ak.us/eh/pest/index.htm](http://www.dec.state.ak.us/eh/pest/index.htm).*

## **PESTICIDE APPLICATOR CERTIFICATION**

Under federal and state law, any person who applies substances that are on the federal list of restricted-use pesticides must be trained and certified by the relevant state agency to do so. Restricted-use pesticides are identified as such on the label. Many of the tracking powders, fumigants, and other poisons are in this category, while most of the “over-the-counter” anticoagulant bait formulations are not. (See note on next page about possible reclassification of several common rodenticides.)

Furthermore, under Alaska law anyone who “engages in custom, commercial, or contract application” of any pesticide, or supervises the use of a pesticide, on property other than that belonging to the person or his/her employer, must have current state certification, or work under the supervision of someone who does.

In short, employees of privately owned facilities like fish processing plants and private marinas currently can use nonrestricted pesticides without certification. Employees of municipal, state, or federal ports or harbors, or of commercial facilities that are open to public use, must be certified.

All products purchased and used must be federally and state registered, records may need to be kept, and use on state land may require a permit. There may also be posting, prenotification, storage, and disposal requirements. Check with the Alaska Department of Environmental Conservation (ADEC) Pesticide Program office at 1-800-478-2577 for details.

ADEC issues certification to individuals who pass a test administered by the department. Alaska Cooperative Extension Service extension agents in Anchorage, Kenai, Delta Junction, and Fairbanks teach an in-person certification course. An in-person initial certification course takes two days and costs \$40. Classes are held several times a year, based on demand. Contact ADEC for additional options. Training schedules are posted on the ADEC Web site, [www.dec.state.ak.us/eh/pest/index.htm](http://www.dec.state.ak.us/eh/pest/index.htm).

Certification is usually good for three years and there is an annual \$25 relicensing fee. Recertification can be done via one-day in-person refresher training, by correspondence, through the annual recertification workshop held in Anchorage, or by earning 12 ADEC-approved continuing education credits in a certification cycle. A recertification conference is held annually in Anchorage.

A cost-effective way for a waterfront facility to meet certification requirements is for the staff supervisor to become certified and then oversee the pesticide application work of the staff.

## BAITS

Blocks, pellets, and meal are commercial formulations in which a very small quantity (typically 50 parts per million by weight) of anticoagulant compound is mixed with grain and machine extruded in the same way pet food is made. Some blocks are made with paraffin for use in damp locations where pure grain blocks would quickly spoil.

## Anticoagulants

**First-generation anticoagulants**, the best known of which is **warfarin**, require multiple doses, and there is documentation of rats developing genetic resistance to warfarin. Warfarin is no longer used by professionals but may be the active ingredient of some low-cost over-the-counter rodenticides. (Warfarin in carefully controlled doses is prescribed as a blood thinner to human patients with certain heart and circulatory problems.) **Diphacinone** and **chlorphacinone** are other commonly used first-generation anticoagulants.

Popular second-generation anticoagulants include the compounds **brodifacoum**, **bromadiolone**, and **difethialone**. These compounds are formulated in numerous brand name rodenticide bait products. All are considered “single-dose” rodenticides; a single consumption of bait will kill a rat.

Brodifacoum is perhaps the most popular compound, and is sold under the trademarked names Talon, Final, D-Con, Enforcer, and Havoc. Bromadiolone is sold as Maki, Contrac, Hawk, and Boothill, all trademarked names. Difethialone is sold as Generation and Hombre.

*Note: At this writing the EPA is considering a proposal to reclassify brodifacoum, bromadiolone, and difethialone as restricted pesticides. If adopted, this proposal would have two effects: (1) They would no longer be sold “over the counter” and could be applied only by state-certified persons, irrespective of the location. (2) Only product with the correct label could be used, even by certified applicators. That means supplies of the rodenticide sold before the classification change would have to be returned to the factory for relabeling, or disposed of according to the label, but could not be used. Check with ADEC before purchasing or using any of these three rodenticides.*

**Second-generation anticoagulants** are the most popular chemicals for general rodent control, and are considered safe to use around people, pets, and wildlife, provided that proper procedures are followed. Toxin concentrations are low enough that consumption of small quantities are **unlikely to be fatal** to





A typical anticoagulant rodenticide block. Courtesy Bell Laboratories, Inc.

people and pets, and “secondary poisoning” of pets or wildlife from eating sick or dead rodents is also unlikely. However, should a child or dog eat a quantity of any of these baits, they could become seriously ill.

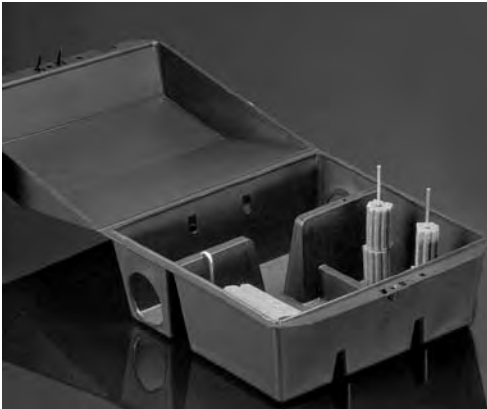
Some (not all) rodenticides have safety features, including antidotes, **bittering agents** added to the formula that make the baits unappealing to children and pets, and dyes (typically green) that distinguish them visually. The green dye also shows up in the droppings of rodents that eat the bait.

**The antidote to most anticoagulant poisons is vitamin K1. A person or pet suspected of consuming poison bait should be rushed to emergency medical treatment. If possible, take a label or product information sheet so that emergency room staff will know what antidote to use.**

## **Non-anticoagulants**

Non-anticoagulant rodenticides include the compounds **bromathalin** (sold as Fastrac and Top Gun), **cholecalciferol** (Quintox), and **zinc phosphide** (sold as ZP Rodent Bait).

Bromathalin is approved for use inside some kinds of food facilities. It is a single-dose toxin but takes two to four days to kill. Cholecalciferol (concentrated vitamin D3) is also single-dose poison, but it is more dangerous to pets than the other choices and should not be used where dogs or cats are present. Zinc phosphide, which smells like garlic, is a black powder used in baits or tracking powder, and can be mixed with fresh food to make a bait. It



Note the baffles in this bait station that prevent larger nontarget animals, such as dogs and foxes, from reaching the bait. Courtesy Bell Laboratories, Inc.

works very quickly on rodents but is moderately toxic to people and must be handled with even more care than other rodenticides.

## NONTARGET SPECIES

There is legitimate concern about the poisoning of nontarget species by grain-based baits. Baiting in the Pribilof Islands has killed a few lemmings. In other parts of the country, broadcast baits used away from inhabited areas have killed small native rodents, ducks, and songbirds. Small predators such as foxes are vulnerable if the baits are not enclosed in stations designed to exclude all but the target species-size animals. The best prevention of nontarget poisoning is proper deployment and use of effective station boxes.

## USE OF RODENTICIDES

Every commercially sold container of rodenticide has a label that identifies the product, lists ingredients, and provides other information pertinent to its safe and effective use. **Read the label carefully, heed the warnings, and adhere to the application instructions.** If using the product over a sustained period of time, reread the label at least monthly.

If the rodenticide is to be applied in areas frequented by the public (or pets), inform potential users of the site or, better yet, post notices alerting the public. Placement should be out of sight and reach of children and nontarget

animals. If baiting in areas where pets or livestock are kept, those animals should be confined during the control operations.

The key to effective rodenticide use is **proper placement**. Toxicant baits are not volatile enough to send out a scent trail that rats will follow any distance. Rats are unlikely to find them by smell alone. This in part is so that nontarget animals are not attracted to them. The bait has to be placed where the rats will approach it directly—in their burrows, adjacent to food sources, or directly in their path of travel.

Rats are **neophobic**—fearful of new things in their environment. As with traps, they may avoid baits for days before finally becoming comfortable enough with their presence to investigate. Pre-baiting with nontoxic food may help overcome neophobia and trap-shyness. Sometimes foods or nontoxic baits such as De-Tex Blox are deployed first to check the presence and abundance of rats in situations where rodenticide use is restricted.

**Fresh baits** are sometimes made by mixing a rodenticide compound with fresh food. While not a common practice, it is sometimes effective where pre-baiting with nontoxic foods for a few days has conditioned rats to accepting new foods.

Since the poison takes 3-18 days to kill, the animals usually die in their burrows or elsewhere distant from the bait. Don't expect to find carcasses on site.

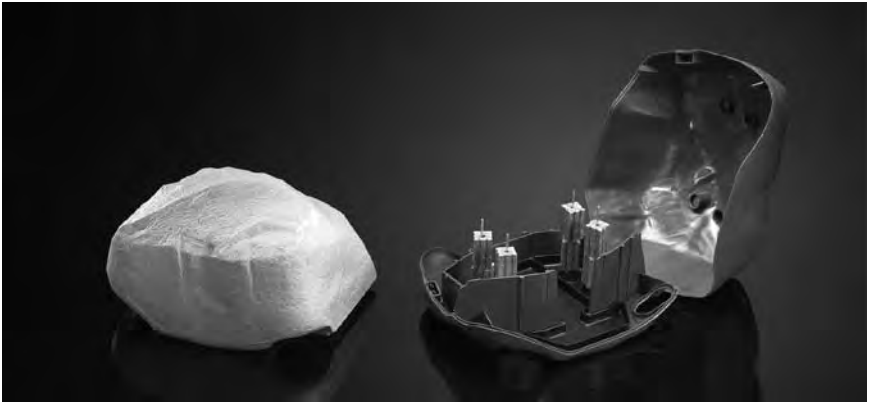
Human scent, dead rats, and feces do not deter rats from taking baits. They are accustomed to human scent in their environment. Other rat bodies and feces contain pheromones that attract rather than repel healthy rats. However, carcasses should be removed as soon as possible to minimize odors objectionable to humans and attractive to other scavengers, and to avoid attracting flies.

In extended baiting programs, it may be advisable to switch periodically between classes of rodenticides to prevent chemical resistance.

Baits deployed in damp areas such as the waterfront, or where they are in contact with rain and snow, can quickly degrade. They must be checked frequently, and must be used strategically in high risk locations rather than in spatially uniform distributions.

Rats will avoid baits that are moldy or decomposing. While bait blocks have at least a year of shelf life and are capable of remaining attractive and potent for extended periods in ideal conditions, they should be replaced frequently if they get damp or otherwise deteriorate.

*Note: Rodenticides sold for commensal rodent control are not labeled for use in natural areas or along waterfronts away from structures.*



Some bait stations are manufactured to look like rocks and blend into the landscape. Courtesy Bell Laboratories, Inc.



Inside the bait station the bait block should be secured on a metal rod so that it can't be moved by wind or water, and animals can't drag it outside. The station itself also should be fixed in place.

## BAIT STATIONS

Commercially built bait stations are of two types: heavy duty tamper-resistant (lockable) plastic or metal boxes, and light duty cardboard or plastic boxes for indoor use. Both are designed to provide harborage to traveling rodents and at the same time offer access to block or pellet baits. Most outdoor stations are black or gray plastic cubes with appropriately sized openings; some look like rocks, for use in parks where they blend into the landscaping.

Bait stations should be **secured** in their locations, and the bait inside should likewise be secured on a metal rod or by other means so that a rat can't





This bait station hasn't been tended recently. Note lack of bait, and a closer look would reveal many fecal pellets.

drag it outside. All baits, inside stations or not, should be secured or placed so that they cannot be moved to places where they are accessible to people, pets, or nontarget wildlife. If roof rats are suspected, bait boxes should be placed above ground level and secured so they don't fall.

If children could visit the site or if tampering is a possibility, the box should be kept **locked**.

Bait stations should be **checked regularly** (preferably weekly and more if infestation is heavy, or if bait shows signs of deterioration) to replace bait and clean the box. However, if it is determined that rats are actively feeding at the station, avoid opening the boxes because change might cause rats to avoid the station. Each inspection should be recorded in a logbook.

Ensure there's enough bait in the stations to accommodate the number of rats using the stations. Each animal eats up to an ounce per day.

If many bait stations are deployed, their locations should be determined by GPS and marked on a detailed site plan so that they **can be found** later.

Bait blocks should be used only in closed bait stations and should not be pushed down burrow holes or into runs. Rats will push them out if they block passage, which then puts them into range of nontarget animals.

Spacing and location of bait stations is determined by the density of the rat infestation, and the layout of the site. Stations should be along the edges of walls, and near burrow entrances and other places that are attractive feeding, harboring, or traveling locations. All likely travel routes should have bait stations, and corners and intersections are good locations. The idea is to



Bait pellet packets can be placed in tight spaces. The packets keep the bait fresh, and rats will chew them open to get the bait. It is important never to lose control of baits; place them only where you can recover them, and where pets and children won't find them. Courtesy Woodstream Corp.

provide stations as convenient **shelter and concealment** for rats traveling exposed routes. In infested area stations should be spaced every 15 to 50 feet.

The openings of the bait stations should be parallel to the line of rat travel.

Commercially manufactured bait stations may be less than optimal for outdoor Alaska use. A biologist with the Alaska Maritime National Wildlife Refuge has developed designs for Alaska harbors that are more resistant to damage, snow, nontarget species, and human tampering than the commercial models. See Defensive Trap Stations for Alaska Conditions in Chapter 7 for descriptions of these specially designed trap/bait stations.

## **PELLETS, MEAL, AND LIQUID BAITS**

Poison pellets and meal come in packets and in bulk, loose in buckets.

**Packets** can be placed in spaces too small for a person to enter, and the rats will chew them open to get the bait. Pellet packets should not be placed unprotected in inaccessible spaces or in burrows, or made to block passages. Like bait blocks, pellet packets will be pushed out in the open unconsumed if they impede rat passage.

Packets help keep baits fresh. Since rodents have to gnaw into them, they confirm the presence and type of rodents involved. However, the convenience of packets often leads to indiscriminate tossing of bait without adequate control of placement.

**Loose pellets** can be placed in burrows or into inaccessible space, using a long-handled scoop or similar implement. A sprinkling of pellets or **meal** will readily be accepted by rats traveling through the space. The amount of pellet or meal distributed should be proportional to the amount of rat sign observed in the area. Better to over-bait than under-bait, but excessive bait is a cost and a potential hazard.

Rats can carry pellets to their nests or other locations, causing the exterminator to lose control of his toxicants. This is called translocation and can be hazardous. Meal baits are less prone to **translocation** problems, but meals absorb moisture more readily than pellets and are less effective in damp locations.

Baits put in burrows should be inserted far enough (one to three feet) that they **can't be seen** from outside. This minimizes translocation. Don't cave in the burrow entrance after baiting. One or two weeks after baiting, cave in the burrow entrance or block with paper, and then inspect a few days later to see if rats are still using it.

Pellets, like bait blocks, should be not be used inside human habitation, to minimize the potential for accidental contact. In general, pellets should not be used in bait stations. If for any reason they are, they must be contained in a bait station that is designed to prevent the bait from spilling out if it is bumped or kicked.

**Liquid baits** are for use in locations where rats have no ready source of free water to drink. They should only be used in places inaccessible to children and nontarget animals.

**Nontoxic** or "**census**" baits formulated without the toxic ingredients can be used for monitoring to detect the presence and indicate the numbers of rats without the risks of rodenticides. Nontoxic baits can be used in locations where toxicant use is tightly restricted or prohibited to test for the presence and abundance of rats. For example, De-Tex Blox are paraffin bait blocks that contain no poison. Once gnaw marks are found, traps or rodenticides can be efficiently deployed. When doing perimeter or fencerow baiting, dozens or even hundreds of stations can be deployed without fear of killing nontarget animals. If rats are indicated, the nontoxics can be replaced with rodenticides.



## **FOLLOW-UP AND RECORD-KEEPING**

Dead rats should be removed wherever they are found. Dispose by burial or incineration. If possible, determine the cause of death, as that may be helpful in determining if something other than poison baits is killing them, and if other predators may be exposed to the poison.



**Wear disposable gloves when handling traps and removing dead animals. Avoid touching carcasses, feces, and contaminated substances, and avoid breathing dust in the vicinity.**

Don't touch dead rats, rat feces, or rat nesting materials or foods, etc. Wear rubber gloves and if possible grasp dead animals with other objects, such as tongs or broom and dustpan. When cleaning rat-infested areas, wear disposable coveralls if it is necessary to crawl in feces and contaminated materials. Wear a high efficiency particulate air (HEPA) respirator if you are exposed to dust composed of dried rat dung.

Store unused bait in the original container, in a locked and marked cabinet or pesticide storage area with Alaska Department of Environmental Conservation–required signage. Signs are available from the ADEC Pesticide Program (1-800-478-2577). Regulatory requirements are found in 18 AAC 90.615.

Record placement of bait stations, dates of inspection of stations, amounts of bait replaced, any dead animals seen, and any observations of the sites. This could include green fecal pellets, untouched baits, consumed baits, moved baits, feces inside bait stations, and anything else that may indicate activity in and around the baits. Records of rodenticide applications are required to be maintained for at least two years following application and must be available to ADEC upon request. The specific records required can be found in 18 AAC 90.400-420.

**Always remember to read and follow the pesticide label . . . it's the law. Remember that all products sold and distributed in Alaska must be federally and state registered. The ADEC Web site has information about pesticides registered in Alaska, [www.kellysolutions.com/ak/](http://www.kellysolutions.com/ak/).**

### **TRACKING POWDER AND FUMIGATION**

Most popular rodenticides are made of poison combined with grain or seeds, and are formulated to be eaten. Tracking powder and fumigants are not designed for eating, but kill in other ways. Like “food” rodenticides, tracking powder and fumigants can be applied only by people certified for pesticide application.

#### **Tracking powder**

Tracking powder is a dust-like mixture of talc and a much higher (up to 40 times higher than edible bait) concentration of poison. It is used when conventional baiting is ineffective, and is applied to runs where rats frequently travel. The powder clings to their feet and fur and is ingested when rats groom themselves by licking. Tracking powder is typically applied in small amounts to burrows and holes.

Tracking powder can be dangerous if spread by wind or movement of rats. Zinc phosphate tracking powder can be fatal to humans if inhaled. Tracking powder should be used only where traps and baits are ineffective due to “trap-shy” rats or an abundance of food in the area. It should not be used around human habitation, or in food processing or handling facilities. Tracking powder should be applied only by professionals, and only when conditions warrant.

(Nontoxic flour or talcum powder can be sprinkled on suspected rat runways to indicate if rats are using them. There is no risk to humans or nontarget animals from using these benign substances.)

#### **Fumigation**

Another form of chemical management is fumigation. The agent is hydrogen phosphide gas, which is produced when tablets or pellets are exposed to air and moisture. The gas is highly toxic to just about everything. Fumigation is used on cargo containers, railroad cars, and sometimes buildings. It can only be done by licensed professionals.





# **Part II:**

## **Administering a Rat Control Program**



# 9.

## Overseeing Integrated Pest Management

The key to successful IPM is effective administrative management.

Control at a site must be coordinated with control at neighboring sites, and in the entire interconnected community, including business and residential transportation corridors. Sanitation, harborage reduction, and exclusion at the target site are effective as long as all employees, tenants, and neighbors are engaged with the program, and efforts are replicated throughout the contiguous community.

It is generally ineffective to attempt to control rats at a single location. Waterfront facilities are usually close enough to residential and business districts for rodents to travel freely between the two zones. A rat “harvest” campaign at one site simply opens up habitat to be recolonized by offspring of survivors and by new arrivals, including from nearby properties. Such a program can actually result in more rats moving in a few months later if the dominant animals that had been defending territories in an area are removed.

Good management ensures adequate funding for the program, proper application of funds, accountability, clearly identified objectives, means of assuring compliance and effectiveness, assessment of results, and dissemination of resulting information.

Several components combine to make for effective management, including:

1. A written project plan.
2. Interagency coordination.
3. Staff training.
4. Public information and public involvement.
5. Clear agreements and enforced standards for lessees and site tenants.
6. A well-written contract with the pest control operator.
7. A well-defined and adhered-to schedule with daily and seasonal tasks.

8. Rigorous data collection and recording.
9. Measurable criteria for success.
10. Plans for adaptation to changes in the rat population and distribution.
11. Long-term commitment to maintenance-level control and monitoring.

## **THREE PHASES OF A RAT CONTROL PROGRAM**

An IPM program consists of three phases: start-up, operational or “attack” phase, and follow-up or continuing vigilance.

**Start-up** includes educating key participants about the need for the program to ensure their “buy-in,” and defining their roles in it. It is important that representatives from all the entities engaged with the facility or existing in the geographic location are brought into the project. For example, harbor users, businesses that store gear there, shippers, recreational users, owners of neighboring upland sites, the city administration, and the public all have to define their roles in the program. Responsibilities need to be specified in contracts and job descriptions. Program design, based on risk assessment, is part of the start-up phase.

The **operational** phase includes refinement of the program design, surveillance and monitoring, training staff, implementing sanitation and harborage control, conducting lethal removals, record-keeping, and evaluation.

**Follow-up** includes reviewing records for indications of success, evaluating results for re-shaping the project, and conducting ongoing monitoring and maintenance trapping and/or baiting.

A **written site-specific plan** helps to specify stages of program operation, to guide the operations of the pest control professional (PCP) or designated staff, to detail sanitation and harborage-related activities, to ensure adequate record-keeping, and to outline useful measures for evaluation. The plan shifts pest control from a reactive response to a proactive, prevention-oriented program. The plan can be in narrative form or can be structured as a Standard Operating Procedures (SOP) document as long as it encompasses all the points that must be covered. See Chapters 10, 11, and 12 for tips on plans, SOPs, and contracting.

**It is the responsibility of the project management to ensure that all legal requirements pertaining to pesticide application are met, including permitting, pesticide training certification, storage, record-keeping,**

**posting, and notification. These responsibilities are imposed by the Federal Insecticide Fungicide Rodenticide Act (FIFRA) and Alaska 18 AAC 90.**

## **RAT CONTROL CHECKLIST FOR COMPLYING**

A facility known or believed to harbor murid rodents is required by state regulation to have and implement a control plan. A facility that currently does not have rodents may benefit from using the same policies to prevent rats from becoming established. Following is a checklist of actions that would ensure compliance.

1. A written rodent control plan is printed and kept on file.
2. Site tenants and users, neighboring facilities, relevant agencies, and the general public are notified of the plan and have access to the written document.
3. Facility staff are made familiar with the plan, taught to survey and inspect for rodent sign, and trained in policies and procedures of Integrated Pest Management.
4. The facility manager assigns responsibilities for carrying out the plan, including a project manager, and designates staff members to carry out specific control tasks
5. If a pest control professional is to be contracted or hired, a service or employment contract is drafted and signed, and a copy is kept on site.
6. A thorough initial survey (inspection) is made of the property to ascertain the existence, extent, and location of rodent colonies.
7. Potential food sources are identified, eliminated, or contained behind rodent-proof barriers.
8. Potential harborage, including places for nesting, feeding, and movement, are identified and removed where possible.
9. Natural and ornamental vegetation is cleared or trimmed back.
10. Rodent access points to buildings, structures, and enclosures are blocked.
11. Access points to the facility are protected by defensive stations.
12. Perimeters of buildings, floats, and/or ramps are protected by defensive stations.



13. Where possible, defensive stations are secured to immovable objects to prevent them from being dragged off or pushed into locations where they will be ineffective.
14. Vessel mooring and off-loading sites are guarded with defensive stations, gangways are well lighted at night, and rat guards are required where appropriate.
15. Staff or designated representatives inspect incoming vessels and other conveyances where appropriate for presence of rodents and rodent sign.
16. Locations of all bait stations, traps, and other control methods are mapped and recorded.
17. A schedule for tending stations and traps is established and maintained.
18. All control activities are logged, and reported regularly, such as monthly. At facilities with no rodents regular reporting can be less frequent.
19. Facility manager annually reviews the plan and all reports submitted by staff or contractors to assess effectiveness and to make changes if appropriate.

# 10.

## Developing a Rat Control Plan

A written IPM rat control plan for a waterfront facility need not be lengthy or excessively detailed. It should contain all or most of the following, and may include other considerations specific to the site.

- **Purpose.** Is the facility already infested or is the purpose to prevent rats from arriving and becoming established? Has there been infrastructure damage or complaints from the public? List intended objectives.
- **List of participants.** What agencies and interest groups are concerned and should be included in training and communication? Examples include harbor or plant staff, facility tenants and users, the local city administration, federal or state agencies that use or visit the site, and neighboring businesses or agencies.
- **Program organization.** Will the project be run by the entity writing the plan, or by a stakeholder committee? Who will maintain administrative control and assume responsibilities for quality control, liability, etc.? Will staff do the work? Will contractors such as commercial pest control professionals (PCPs) be involved? Who will evaluate results and make changes?
- **Community and public relations.** Neighboring entities and the public at large must understand and support the project. There may be public opposition, particularly when toxicants are involved, and it's necessary to proactively address those concerns. Good public information helps enlist the whole community to improve sanitation, decrease harborage, and raise overall awareness. Who will conduct public relations and what means will they use?
- **Staff responsibilities.** What will be the roles of individual staff members? How will management overcome staff reluctance to perform some duties?
- **Staff and contractor training.** Contractors should be qualified to perform general pest control tasks, but they may need training in the

specifics of the site. Staff members must be clear about their roles. How will this be accomplished?

- **Scheduling.** Make up a timetable for project initiation and for benchmarks. Set deadlines for activities such as site cleanup and removal of trash or debris. Set a realistic date for initial results to show and for project first evaluation.
- **Surveys and monitoring.** Specify a plan for initial site survey and for a continuing monitoring program. Weekly inspections should look for presence of rats and should reveal conditions of sanitation, harborage, and infrastructure problems. Inspections should be scheduled for day and night. A process should be included to ensure that the proper person or department is notified of problems observed.
- **Sanitation and harborage management.** Specify the plan for keeping the site free of foods and, to the extent possible, cover and harborage for rats. This may involve regulation and enforcement as well as public awareness.
- **Lethal measures.** If current infestation mandates trapping or baiting, or if preventive (interdiction) trapping or baiting is indicated, state the purpose, extent, and strategy. Set schedules for tasks such as checking traps and bait boxes. Don't forget maintenance baiting after the initial program.
- **Infrastructure design and construction.** Where appropriate, detail pest-proofing standards for design and construction or renovation of structures on the site.
- **Site maintenance.** Specify standards for infrastructure and site maintenance to minimize rodent access.
- **Record-keeping, reporting, and data management.** How activities will be recorded, and data compiled and managed. How will data be used to make future decisions? Record-keeping should facilitate program improvement through determination of program gaps, modification of outreach efforts, and better contract management.
- **Criteria for evaluation.** How will managers know the program is successful? This may be as simple as "Again no rats detected." Or it may be an analysis of some quantitative factor such as complaints, burrows counted, etc. Include a process for using the evaluation to scale up, scale down, or revise the program.

- **Standard Operating Procedures.** See the next chapter.
- **Budget.** An IPM rat control program should have its own budget. It may be a line item in a facility's general budget. What are sources and dollar amounts? How will an ongoing program be maintained financially?

An effective interdisciplinary plan can be written in an hour or two. Roles and responsibilities can be listed on a spreadsheet that details every objective and each action needed to accomplish that objective. The plan must be easy to understand, with clear action items, a schedule, and responsibilities assigned to each department or segment of the public.

The IPM plan should be distributed to all program participants, including operators of neighboring facilities and interested public. Periodically the plan should be reviewed and modified if appropriate.



# 11.

## Standard Operating Procedures for Waterfront Facility Rat Control

### SAMPLE STANDARD OPERATING PROCEDURES (SOP)

#### Purpose

The purpose is to apply IPM at the facility to keep rat populations at the lowest level practical, to prevent any rats on the premises from boarding vessels, and to prevent rats from gaining access to the site and becoming established. “Zero tolerance” (no rats present) is required by new Alaska Department of Fish and Game regulations.

#### Responsibility

Under direction of the facility manager, the facility staff members carry out the program outlined herein. Other agencies and tenants of neighboring facilities share responsibility for cooperative action. Pest control professionals (PCPs) may be contracted to assist in the program.

Staff members are **expected to inform** site tenants, service providers, persons or vessels that deliver product or supplies, and visitors about the program and to enlist their assistance in conducting these procedures as appropriate.

Staff members also are authorized to report **willful or unintentional violations** of rules, regulations, or IPM principles at the facility to management.

Harbor management and staff encourage participation of all local agencies, organizations, and companies that use the facility, that are neighbors to it, or that have an interest in rat control for health, safety, or aesthetic reasons.

## Principles

IPM emphasizes the following principles for controlling rats:

**Eliminate sources of food.** Maintain strict sanitation, contain garbage in rodent-proof containers and dispose of frequently, and remove sources of natural foods, such as seed-bearing native vegetation.

**Eliminate potential harborage** (shelter and concealment). Block potential points of access to buildings and to the facility yards.

**Use lethal control where appropriate.** In conjunction with good sanitation and physical site management, use traps and baits to interdict rats from vessels or access points on land.

## Record-keeping and reporting

All procedures outlined in this section should be **performed on a schedule** and in accordance with a recording format.

All **activities should be recorded** on reporting forms that are kept at a central location and made available for review and program analysis.

One staff member should be designated as keeper of rat IPM reports.

Records should include updated **maps or site plans** that show rat control-related devices or activities, including rodent-proof building modifications, location of traps, location of bait stations, etc. Traps and bait stations should be numbered or otherwise coded, and site plans should include descriptive information to make them easy to locate. Records must be maintained for at least two years for rodenticide applications and provided to the Alaska Department of Environmental Conservation on request.

If several facilities or landowners work together, it could be effective to have one technician keep the data in a GIS format, which could produce maps showing rodent hot spots, control devices, and other pertinent information.

## Inspections

A general facility inspection should be **made and recorded weekly**. The purpose is to detect the presence of rats, and to identify means or locations where they could enter the facility and become established. The people making this inspection should note and report to management the following:

- Any sign of rat activity, including live or dead animals, droppings, evidence of chewing or gnawing, rub marks, rat tunnels or burrows, etc.
- Food, garbage, or other edibles that could support or attract rats.



Tie-up lines, gangway, bullrails, and stored equipment all provide access and concealment for rats jumping ship in this port. Keeping the area as clear as possible, and placing bait stations behind the bullrails to intercept any animals that debark here, would do a lot to prevent rat infestation.



This is an effective rat-proof trash receptacle. Note heavy construction and closely spaced bars preventing rat access. It could be improved with a swiveling or pivoting top to prevent birds from entering and scattering trash



- Debris, stored goods, fishing gear, or equipment that could provide harborage.
- Potential means of access, such as ships moored without rat guards, gangways and ramps that are not secured with trap or bait stations, etc.
- Check any incoming containers or goods with indications of rats aboard.

## **Rat control points**

Take action to ensure that rats are suppressed if already present, and do not become established if they have not already done so. Attend to the following control points:

### **FOOD**

- Ensure no human food, garbage, or natural foods are available.
- Use rodent-proof trash cans and dumpsters, and ensure trash doesn't spill out.
- Ensure that trash is collected regularly and frequently, preferably in the evening.
- See that food service outlets like restaurants handle garbage correctly.
- Ensure that site tenants and visitors dispose of garbage correctly.
- Block rat access to fish processing waste, sportfish cleaning tables, etc.
- Immediately clean up spilled food products or edible substances.
- Remove natural food sources, such as seed-producing vegetation and dead marine life.

### **HARBORAGE**

- Keep all exterior doors closed except when people or vehicles are passing through.
- Install and maintain door sweeps, rodent-proof flashing, and other physical barriers.
- Plug all holes and gaps around foundations and in building walls and floors.

- Maintain rodent-proofing barriers to wire chases, plumbing lines, windows, etc.
- Maintain an 18 inch space between walls and goods or equipment stored inside buildings or adjacent to exterior walls.
- Remove debris, junk, abandoned equipment, vehicles, fishing gear, and other materials from the site that could provide shelter or concealed travel routes.
- Require fishermen to shake out or visually inspect stored nets, pots, and lines prior to loading onto vessels or storing inside buildings.
- Require effective placement of rat guards on all ship mooring and service lines.
- Use lighting at night to reduce potential rodent concealment.
- Place trap or bait boxes around gangways, ramps, and loading floats.
- Block sewer, drainage, and other access points with screens.
- Break up straight access lines in gutters, alleys, and roads with physical barriers or by removing sight barriers to open up the space and decrease concealment.
- Place traps and bait boxes along travel corridors and in locations that provide concealment to stop rats that may attempt to use them.



**This row of concrete bulwarks provides a good rat travel route. Defensive stations could be spaced along the seaward side.**

## **LETHAL CONTROL**

- Use mechanical traps in food processing or storage and human-occupied spaces
- Where necessary, use rodenticides in exterior locations. Read and follow the label.
- Place bait stations to minimize accessibility to people, pets, and nontarget wildlife.
- Tend traps and bait stations at least weekly. Reposition them if they appear ineffective.
- Maintain traps and bait stations, even when no rats are being caught or detected.
- Record all station movement, bait consumed, animals caught, and other data.

# 12.

## Contracting with a Pest Control Professional

One cornerstone of Integrated Pest Management is “direct intervention,” which means killing pests with traps or poisons (see Chapter 7 Traps, and Chapter 8 Rodenticides). The work can be done by facility staff or by a contract with a pest control professional (PCP).

Because of the requirement for certification to use pesticides, and because of the specialized skills involved, some facilities managers find it cost effective to contract with PCPs. Results obtained can often be linked to the selection of the right PCP and to the specific terms of the contract. Check with the Alaska Department of Environmental Conservation to make sure the PCP you hire is certified, licensed, and insured as mentioned below, by calling 1-800-478-2577.

### SELECTING A PCP

Some PCP firms develop IPM programs for their clients; others provide only “extermination” or pesticide application services. It’s best to determine in advance what kind of service you want.

While it is customary to take bids for services, pest control is one place where the low bidder may not be the best company for the job. A company that simply throws out bait packets and checks traps and bait stations periodically may convey the impression that it’s doing something, but what counts is how effective it is at eliminating or controlling rats.

Bids are based on hourly rates and consumables such as bait, so the more thorough the contractor is the more the service will cost.

Factors to consider when selecting a PCP:

- Are the workers properly certified for pesticide application? Check documents.
- Is the company licensed, bonded, and insured for liability? Get certificates. You may want your facility to be named as additional insured on the PCP company’s public liability policy.



The boat harbor at Homer is one of many in Alaska not currently infested with rats. Careful application of preventive measures can keep it that way.

- Does the company provide all its own equipment and materials?
- Does it have previous experience in waterfront rat control?
- Does it have a good reputation; can it provide references?
- Are they using registered rodenticides?

Get a written protocol from the prospective contractor, including requirement for a maintenance log, timetables, and copies of product labels of toxicants to be used.

Some agencies, such as the federal Department of Defense, use a **performance-based** contract renewal process. The agency specifies the results it expects from the program, and renews the contract for a year or multiple years depending on how well the PCP performs toward meeting those expectations.

## **LOCAL HIRE**

The daily rate charged by commercial PCP firms, combined with high travel and lodging costs, can make contract pest control prohibitively expensive in remote communities. In some cases facility staff can be trained and assigned rat control responsibilities. Another option is to contract on a part-time basis with a local person who is familiar with IPM and is a certified pesticide applicator. Training is available on request (see sidebar on Pesticide Applicator Certification, page 48).

A local contractor can cost the facility far less, and would be available on short notice. Such an individual could develop accounts with other facilities or agencies in the area and provide a more coordinated pest control program than could a facility staff member.

## WRITING A PEST CONTROL CONTRACT

Some companies have a standard contract template in the corporate computer; others write a custom contract for each client or “account.” The facilities manager, therefore, has some leeway in setting the terms of the contract with the PCP. If there is no “standard” contract, the facilities manager must ensure that the contract specifies all the work to be done, responsibilities, a schedule, remedies, measures of performance and success, etc. Be sure to include emergency contact information with every document.

To ensure you’re getting a good value in your PCP, **it is important to understand rat control.** Following are some components of a rat control contract.

## SIMPLIFIED RAT CONTROL CONTRACT TEMPLATE

- **General program description.** The purpose of the contract. It may include terms like Integrated Pest Management, long-term pest suppression, monitoring, and evaluation.
- **Target pests.** If the project is specific to rats, say so, or specify others, e.g., mice, insects.
- **Commercial terms.** Define terms used in contract: “contractor,” “the work,” “site,” etc.
- **PCP’s licenses and insurance.** Include a list, and require copies of insurance certificates.
- **Specifications.** Specify materials, supplies, equipment used; for example, type of bait stations, how they are secured and marked.
- **Initial and periodic inspection and monitoring.** How contractor will assess the presence or absence of the target animals.
- **Planning.** Require the PCP to draft and present a written plan for the program.
- **IPM recommendations.** The PCP should make recommendations regarding nonlethal approaches to rat suppression.

- **Control methods.** Specify control methods to be used.
- **Pesticides and their use.** Specify that the PCP is responsible for all pesticide transport, storage, and application. Require that all pesticide handling will be done in full compliance with pertinent state and federal laws. Specify that pesticides will be applied in the safest and most conservative manner that accomplishes local pest control goals.
- **Structure or site modifications and recommendations.** Indicate that the PCP is expected to recommend structure modifications when appropriate to site management.
- **Scheduling and time of service.**
  - Begin and end dates of contract.
  - Timeline for initial inspection, drafting of action plan, evaluation periods, etc.
  - Schedule of activities—checking baits and traps, replacing baits, by location.
- **Special requests and emergency responses.** How will the contractor respond to service needs that fall outside the description of work in the contract?
- **Data, record-keeping, and documentation.** State what records are to be kept, by whom, and in what form. Specify how data will be analyzed to adjust the program as needed. See Chapter 10 on plan development for more details on appropriate record-keeping and reporting.
- **Program evaluation.** Process for evaluating program effectiveness and public acceptance.
- **Payment.** Specify terms and schedule for payment, and method for resolving differences.

# 13.

## Applying HACCP to Rat Control

As a facility manager you can apply the principles of Hazard Analysis Critical Control Point (HACCP) to rat control and management on your property. HACCP focuses on identifying and preventing hazards.

HACCP was developed by the food industry as an approach to assuring the safety and wholesomeness of food products. It has been adopted worldwide, and now is applied to other activities where some form of contamination must be prevented. It is currently used by natural resource agencies in many states to control invasive plants and wildlife.

HACCP is based on seven principles:

- Analyze hazards.
- Identify critical control points.
- Establish preventive measures with critical limits for each control point.
- Establish procedures to monitor the critical control points.
- Establish corrective actions to be taken when a critical limit has not been met.
- Establish procedures to verify that the system is working properly.
- Establish effective recordkeeping to document the HACCP system.

The key to a successful program is careful drafting of the **HACCP Plan**. This is a written document that is used for reference by staff and which should be reviewed and modified or updated periodically.

The first page of a HACCP plan identifies the facility, its purposes, location, and the manager and project coordinator, and it contains a brief narrative project description.

Step 2 identifies the potential “hazards” (in this case, rats) that may cause a problem by entering or becoming established in a facility.

Step 3 is to draw up a verbal or graphic flow diagram illustrating the activities of the facility, and identifying points in that flow where the hazard can enter the process.



Step 4 is the “hazard analysis” and consists of a matrix showing tasks, hazards, probability, justification, and control measures, and indicates whether each line in the matrix is a critical control point. This step requires the most careful thought and thorough effort to make a complete list.

Step 5 consists of listing critical control points. These are physical locations or stages of a process where control measures, such as inspection, can be effective. If you are controlling for multiple hazards, such as insects and mice as well as rats, the critical control points may differ.

The final section of a HACCP plan is a checklist of control activities, for use by staff, contractors, and facility tenants and users.

The U.S. Fish and Wildlife Service has developed a HACCP Plan Wizard for natural resources managers. You can create your own HACCP plan by filling in the blanks on the pages of the online Wizard. It is located at <http://haccp-nrm.org/>.

The following pages illustrate a fictitious boat harbor’s HACCP plan created with the help of the HACCP Plan Wizard.



**This waterfront property has an abundance of rodent harborage and natural food sources. It is in serious need of housekeeping and vegetation removal to aid in the control of rats and other pests.**

**HACCP Step 1 - Activity Description**

<b>Facility:</b> Port Rodentus Harbor	<b>Site:</b> municipal boat harbor and port one mile south of town
<b>Project Coordinator:</b> Carl Commensal	<b>Project Description:</b> boat harbor operations
<b>Site Manager:</b> Bill Ratfree	
<b>Address:</b> 101 Industrial Hwy. S Port Rodentus, AK 90909	
<b>Phone:</b> 907 123-4567	

**Project Description**  
(Who, What, Where, When, How & Why)

The Port Rodentus boat harbor is a municipally owned facility situated on 70 acres of waterfront property one mile south of the town center. It has 50 assigned stalls, and transient space for up to 40 vessels. A boat launch ramp is located at the south end of the harbor. A fish processing plant is located at the north end and takes delivery from vessels that enter the harbor and tie up at its pier. A floating fuel dock is located on the east side of the harbor. The harbor has a fish cleaning shed, various dumpsters and other waste collection units, and a public restroom. Five acres of parking allow harbor users, including launch ramp users, to store their vehicles for periods of up to one week. The harbor serves recreational boaters and a local commercial fishing fleet that operates from California to the Bering Sea, and transient boats that arrive from around the North Pacific. Immediately to the south of the harbor is a break-bulk cargo dock, and to the south of that a barge ramp. To the north of the harbor is an Alaska Marine Highway ferry terminal dock. Cargo vessels up to 1,000 feet in length use the cargo dock to take on wood products, seafood products, and general cargo, and to discharge groceries, building materials and equipment, and bulk grain used by a local food processor to make breakfast cereals.

The activity described in this plan is operation of the boat harbor only, including receipt of incoming vessels, departure of vessels, vehicle management, and waste disposal and management. Overall site management is by the harbormaster, overseeing a staff of seven people. The project coordinator is the assistant harbormaster.

**HACCP Step 2 - Potential Hazard Identification**

**Vertebrates:**

Norway rat

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**Invertebrates:**

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**Plants:**

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**Other Biologics:**

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**Others:**

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**HACCP Step 3 - Flow Diagram**

Task # 1	Receive harbor supplies by truck
Task # 2	Receive fuel at dock by barge
Task # 3	Receive visitor and boat launch vehicles
Task # 4	Place arriving vessels in permanent or transient moorage
Task # 5	Dispose of trash and fish guts, replace containers
Task # 6	Maintain grounds
Task # 7	Patrol water and land portions of site, and perimeters

**HACCP Step 4 – Hazard Analysis**

Task	Hazard	Probable?	Justification	Control Measures	CCP?
Receive harbor supplies by truck	Vertebrate: Norway rat	Yes	Rats could come with cargo in truck.	Tell operators to check trucks and cargos for signs of rats.	No
Receive fuel at dock by barge	Vertebrate: Norway rat	No	Fuel barge not a likely vehicle for hitchhiking rats; no food on barge.		No
Receive visitor and boat launch vehicles	Vertebrate: Norway rat	No	Rats not very likely to travel in private passenger vehicles.		No
Place arriving vessels in permanent or transient moorage	Vertebrate: Norway rat	Yes	Rats could come in on larger vessels, having boarded at unsecured ports.	Interview captain and crew. Hand out rodent kits. Place trap and bait stations at end of fingers and ramps.	Yes
Dispose of trash and fish guts, replace containers	Vertebrate: Norway rat	Yes	Rats are attracted to trash, garbage, dumpsters, and fish guts.	Frequent visual inspection. Trap and bait stations placed in vicinity. Display informational posters.	Yes
Maintain grounds	Vertebrate: Norway rat	Yes	Rats that come onto the site from outside will be attracted to features offering food and/or harborage. Grounds maintenance allows careful inspection, removal of debris, and denial of harborage.	Frequent inspection. Remove debris. Remove materials or equipment harborage. Plug entrances to structures.	Yes
Patrol water and land portions of site, and perimeters	Vertebrate: Norway rat	Yes	Rats are good swimmers and can travel long distances when dispersing overland in response to crowding.	Warn neighboring facilities and communities; enlist them in coordinated prevention and control activities.	Yes

**HACCP Step 5 - HACCP Plan**

**Critical Control Point #1:**

**Task # 4: Place arriving vessels in permanent or transient moorage.**

**Significant Hazards:**

Vertebrate: Norway rat

**Control Measures:**

Interview captain and crew. Hand out rodent kits.  
Place trap and bait stations at end of fingers and ramps.

**Limits for Control Measures:**

**Monitoring: What?**

All possible rat travel corridors and harborage points

**Monitoring: How?**

Visual inspection

**Monitoring: Frequency?**

Daily

**Monitoring: Who?**

Harbor staff

**Evaluation & Corrective Actions:**

Assign additional staff to assist

**Supporting Documentation:**

Daily inspection log

**Critical Control Point #2:**

**Task # 5: Dispose of trash and fish guts, replace containers.**

**Significant Hazards:**

Vertebrate: Norway rat

**Control Measures:**

Frequent visual inspection. Trap and bait stations placed in vicinity.  
Informational posters.

**Limits for Control Measures:**

No trash or guts left during non-working hours on the ground or in any rat-accessible location

**Monitoring: What?**

All trash handling and fish cleaning sites

**Monitoring: How?**

Visual inspection

**HACCP Step 5 - HACCP Plan**

**Critical Control Point #2:**

**Task # 5: Dispose of trash and fish guts, replace containers.**

**Monitoring: Frequency?**

Daily

**Monitoring: Who?**

Harbor staff

**Evaluation & Corrective Actions:**

Containers with automatically closing lids

**Supporting Documentation:**

Daily inspection logs

**Critical Control Point #3:**

**Task # 6: Maintain grounds**

**Significant Hazards:**

Vertebrate: Norway rat

**Control Measures:**

Frequent inspection. Remove debris. Remove materials or equipment harborage. Plug entrances to structures.

**Limits for Control Measures:**

**Monitoring: What?**

**Monitoring: How?**

**Monitoring: Frequency?**

**Monitoring: Who?**

**Evaluation & Corrective Actions:**

**Supporting Documentation:**

**HACCP Step 5 - HACCP Plan**

**Critical Control Point #4:**

**Task # 7: Patrol water and land portions of site, and perimeters**

**Significant Hazards:**

Vertebrate: Norway rat

**Control Measures:**

**Limits for Control Measures:**

No rat-attractive access points to the facility are left unprotected by fencing, screening, or trap or bait stations.

**Monitoring: What?**

Entire perimeter of the site

**Monitoring: How?**

Visual inspection

**Monitoring: Frequency?**

Daily

**Monitoring: Who?**

Harbor staff

**Evaluation & Corrective Actions:**

Additional trap and bait stations

**Supporting Documentation:**

Daily inspection logs

**Facility:**

Port Rodentus Harbor

**Activity:**

Boat harbor operations

**Address:**

101 Industrial Hwy. S  
Port Rodentus, AK 90909

**Signature:**

**Date:**

**HACCP Checklist:**

**Boat harbor operations** (review monthly and when cargo vessels arrive)

**Facility** Port Rodentus Harbor

**Site** Municipal boat harbor and port one mile south of town

**Coordinator** Carl Commensal

**Manager** Bill Ratfree

**Address** 101 Industrial Hwy. S, Port Rodentus, AK 90909

- Task # 1: Receive harbor supplies by truck**
- Task # 2: Receive fuel at dock by barge**
- Task # 3: Receive visitor and boat launch vehicles**
- Task # 4: Place arriving vessels in permanent or transient moorage**  
**CRITICAL CONTROL POINT**
- Hazards were contained  
Hazards: Vertebrate: Norway rat
- Control measures were implemented  
Control Measures: Interview captain and crew. Hand out rodent kits. Place trap and bait stations at end of fingers and ramps.
- Control limits were maintained  
Control Limits:
- Corrective actions were (performed if necessary)  
Corrective Actions: Assign additional staff to assist
- Task # 5: Dispose of trash and fish guts, replace containers**  
**CRITICAL CONTROL POINT**
- Hazards were contained  
Hazards: Vertebrate: Norway rat
- Control measures were implemented  
Control Measures: Frequent visual inspection.  
Trap and bait stations placed in vicinity. Informational posters.
- Control limits were maintained  
Control Limits: No trash or guts left during non-working hours on the ground or in any rat-accessible location.
- Corrective actions were (performed if necessary)  
Corrective Actions: Containers with automatically closing lids.
- Task # 6: maintain grounds**  
**CRITICAL CONTROL POINT**
- Hazards were contained  
Hazards: Vertebrate: Norway rat



**HACCP Checklist:**

- Control measures were implemented  
Control Measures: Frequent inspection. Remove debris. Remove materials or equipment harborage. Plug entrances to structures.
  - Control limits were maintained  
Control Limits:
  - Corrective actions were (performed if necessary)  
Corrective Actions:
  - Task # 7: Patrol water and land portions of site, and perimeters**  
**CRITICAL CONTROL POINT**
  - Hazards were contained  
Hazards: Vertebrate: Norway rat
  - Control measures were implemented  
Control Measures:
  - Control limits were maintained  
Control Limits: No rat-attractive access points to the facility are left unprotected by fencing, screening, or trap or bait stations.
  - Corrective actions were performed (if necessary)  
Corrective Actions: Additional trap and bait stations
-

# 14.

## Outreach and Community Involvement

A key component of Integrated Pest Management is community involvement, which is achieved through effective outreach and information. There are three purposes:

- To change human behaviors that contribute to rodent problems.
- To elicit public support and participation in the rat prevention or control program.
- To allay fears or objections by clarifying risks and benefits.

Effective outreach is **proactive**, not reactive. Information should be provided before it is requested. The community and interested parties should be brought into the project before it is consolidated and certainly before any control actions are taken.

Outreach should be developed in the understanding that many people will be uninterested, and some will be resistant. In many coastal communities rats are simply not viewed as a problem that needs to be addressed. They are considered “part of the waterfront landscape,” even if a slightly annoying or embarrassing part. The problem of enlisting public support may be even greater in communities that don’t currently have rats.

Separate outreach efforts may be needed to reach individual audiences, including site tenants, operators of transient vessels, managers of neighboring properties, local agencies, and the general public.

Outreach messages are best if concise, factual, and positive. Emphasize the personal benefits to members of the target audiences, as well as the greater good. It may be easier, for example, to sell boat owners on reducing threats of damage from rats at the dock than on reducing the possibility that hitchhiking rats will destroy seabird populations in remote Aleutian islands. But both are important messages.

Along with outreach and education there needs to be a process to ensure **response to complaints**. The public is likely to ignore plans of action if they

feel their concerns are being ignored. Furthermore, you may want to consider a system for **collecting penalties** for actions or behaviors that violate the terms of the plan, at least among leaseholders or other facilities users with whom the facility has a legal or contractual relationship. Enforcement directed against violators is one means of ensuring those who do comply that their individual efforts are taken seriously.

## **OUTREACH “TALKING POINTS”**

- Rats are a threat to human health and to buildings and other infrastructure.
- Rats can significantly damage or destroy a vessel or contaminate its catch or cargo.
- Rats are destructive invasive species that can wipe out nesting seabird colonies.
- Rat stocks can be controlled and numbers reduced, and their spread can be prevented.
- Integrated Pest Management accomplishes those goals in an ecologically sensitive way, relying more on deprivation of food and shelter than on poisons.
- Modern rodenticides are relatively humane, and with careful application pose virtually no threat to people, pets, and nontarget wildlife. Provide enough information that the public understands what is being used, where, how to identify it, and what should be done in case a person or nontarget animal comes in contact with it. Make it clear that they must be used in accordance with product labels and with federal and state laws.
- Community members can participate in effective IPM by ensuring that litter and other food sources are not accessible to rats, and that trash and clutter is removed to deprive harborage.
- Community members can assist the program by becoming aware of rat sign and by reporting any sightings of rats or rat sign to the proper authority.
- Community members can also assist by identifying and reporting situations that pose a risk of introducing rats to the area, including vehicles or vessels laden with cargo or in a condition such that they would provide a means of rat attraction or transport.

Be sure to include a **feedback mechanism**. In other words, supply contact names and numbers and encourage the public to contact project managers with suggestions, complaints, or other information about the rat control program.

## **SOME OUTREACH TIPS**

- Provide copies of your rat control plan to site tenants, site users, neighboring businesses, agencies, and any interested members of the public.
- Hold in-person meetings with agencies and decision-makers to elicit buy-in.
- Consider holding public meetings to introduce the program or address community concerns.
- Distribute flyers and fact sheets on the program as broadly as possible.
- Develop press releases and public service announcements to distribute to media outlets, and be available for questions and interviews.
- Encourage citizen rat sighting reports, and consider involving the public in presence/absence surveys.
- Provide specifics on methods of control and prevention that the public can use.
- Where possible, involve schools and school children in rat awareness, sanitation and harborage, and general rat control efforts. Teachers may want to incorporate rat control into their science or other academic lessons, e.g., as part of a curriculum on invasive species.
- Develop a process for responding to complaints or concerns, and reply to public input efficiently and politely.
- Try to provide indicators of success. Dead rat carcasses may not be the best indicators, so look for other ways to show that the program is having its intended effect.



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# Glossary

## (specific to rats)

**Anticoagulant rodenticide:** Substance that kills rodents by hindering the clotting of blood.

**Bait station:** Box with poison bait that provides shelter to rats, for indoor or outdoor use.

**Carrying capacity:** The maximum population of rats that an area will support.

**Census bait:** Bait used for monitoring, to detect the presence and indicate the numbers of rats, without the risks of rodenticides. Also called “monitoring” bait.

**Commensal:** A relationship between two kinds of organisms in which one gets food from the other.

**Defense station:** A site with traps or poison baits to destroy rats.

**First-generation anticoagulant rodenticide:** Poison that causes death, often after multiple doses, e.g., warfarin. (See also second-generation anticoagulant rodenticide.)

**Free water:** Water that is not in food, such as puddles or other pooled accumulation.

**Glue board:** Cardboard with sticky glue that traps pests; nonpoisonous.

**Glue trap:** Another term for glue boards and glue trays; nonpoisonous.

**Glue tray:** Plastic tray with sticky glue that traps pests; nonpoisonous.

**HACCP:** Hazard Analysis Critical Control Point; used to prevent contamination in food processing and other situations.

**Harborage:** Shelter.

**Integrated Pest Management (IPM):** Controlling pests by improving sanitation, restricting entry, inspecting, detecting presence when pest numbers are low, keeping records of control measures, and using low amounts of pesticides.

**Interdiction:** Cutting off access or interception.

**Neophobic:** Afraid of or avoiding new objects in the immediate environment.

**Non-anticoagulant rodenticide:** A rodent poison that kills by some means other than by hindering blood clotting.

**Nontarget species:** Animals that may be trapped or killed unintentionally in a rat control campaign.

**Omnivorous:** Feeding on both animal and vegetable material.

**PCP:** Pest control professional.

**Pheromone:** A chemical produced by an animal that serves as a stimulus to other individuals of the same species for behavioral responses.

**Rat guard:** Sheet metal collar or cone that prevents rats from climbing on mooring lines.

**Repellent:** Chemical or substance that is unpleasant to rats and drives them away; usually nonpoisonous.

**Rodent:** Gnawing animal in the order Rodentia that has in both jaws a single pair of incisors with a chisel-shaped edge.

**Rodenticide:** A substance that kills or controls rodents.

**Second-generation anticoagulant**

**rodenticide:** Potent poison that causes rat death, often after a single dose. (See also first-generation anticoagulant rodenticide.)

**Thigmotaxis:** Orientation or movement based on tactile stimuli.

**Tracking powder:** Toxic powder that rats run through, then ingest during grooming. Its purpose is to kill rats, not to find rats.

**Translocation:** Movement of baits or other toxic substances from a place where they will attract the target animals to another place where they may be encountered by nontarget animals.

**Vibrissae:** Whiskers on the face, and stiff hairs on other parts of the body, that allow rats to feel and interpret the shapes of the spaces and objects they encounter.