Bed Bugs and Other Blood Feeding Vectors

Alameda County Homeless Providers
November 16, 2022
What is a Vector (Health & Safety Code)

- CHAPTER 1. Definitions [116100 - 116108]
- (Chapter 1 added by Stats. 1995, Ch. 415, Sec. 6.)
- “Vector,” as used in Article 1 (commencing with Section 116110) of, and Article 2 (commencing with Section 116120) of Chapter 2, and Section 106925, **means any animal capable of transmitting the causative agent of human disease or capable of producing human discomfort or injury, including, but not limited to, mosquitoes, flies, other insects, ticks, mites, and rats.**
Mission Description

The mission of the Vector Control Services District is to prevent and minimize the spread of vector-borne diseases, injury and discomfort to the residents of Alameda County. Upon request, our Vector Control staff will provide an on-site inspection of your property, neighborhood, or community and evaluate the best methods to control the particular vector through habitat modifications, source reductions, education, integrated pest management practices, and regulatory code compliance.
How Does Alameda County Vector Control Serve Residents?

- Requests for service by residents
- Schedule “on-site” meetings and inspection or investigations
- Identification of vectors and vector signs
- Clear directions on how to resolve detected problems
- Networking with other organizations to help resolve vector related issues
Vector Control Requests for Service
For 2021 (total=6,857)

- 2,208-Rats (combined)
- 1,375 Wildlife Requests for three species
  - Raccoons-560
  - Skunks-590
  - Opossum-225
- 706-Wasps/Bees (combined)
- 303-Mice
- 264-Cockroaches (combined)
- 89-Bed Bugs
- 100-Flies
- 68-Fleas
- 70-mites
- 21-Ticks

5,204 sub total
You Never Know What You Will Find in the Attic
What Are Bed Bugs?

- Visible to the naked eye
- Feed preferentially on human blood
- Attracted to CO₂, body heat & pheromones
- Egg—nymph (5 molts)
- Adult in 4-5 weeks
- Females lay 200-500 eggs in their lifetime
- Adults can live 3-5 months without food!
- Some of the population are dispersing at any given time
The Life Cycle of a Bed Bug

Adults grow to 4–5 mm in length and 1.5–3 mm wide.

- Adults Feed and Mate Multiple Times
- Lays Eggs
- Hatches
- Hungry 1st Instar Nymph
- Blood-fed 1st Instar Nymph
- Molts
- Hungry 2nd Instar Nymph
- Blood-fed 2nd Instar Nymph
- Molts
- Hungry 3rd Instar Nymph
- Blood-fed 3rd Instar Nymph
- Molts
- Hungry 4th Instar Nymph
- Blood-fed 4th Instar Nymph
- Molts
- Hungry 5th Instar Nymph
- Blood-fed 5th Instar Nymph
- Molts
- Hungry Adult Female
- Blood-fed Adult Female
- Hungry Adult Male
- Blood-fed Adult Male

Seeks Host
Leaves Host Fully Fed

Dr. John Anderson CAES
Artist: Bonnie Hamid
How Many Bed Bugs?

- 5 eggs per day for 30 days = 150 bed bugs hatch
- If half are female and mate = 75 and lay eggs for 30 days = 11,250 eggs
- If the 11,250/2 = 5,625 half females lay eggs for 30 days = 843,750... we have a blood feeding army!
Bed Bug and German Cockroach Requests for Service 2000-2021

- Bed Bugs
- German Cockroaches

Bar chart showing the number of requests for service from 2000 to 2021 for both bed bugs and German cockroaches. The data is presented in a bar chart format with years on the x-axis and the number of requests on the y-axis.
National Estimates of Non-canine Bite and Sting Injuries Treated in US Hospital Emergency Departments, Bed Bug Bites 2001-2010

Alameda County Bed Bug Requests for Service 2001-2010
Fighting bed bugs in rental housing takes the cooperation of both landlords and tenants. AB 551 provides a framework of rights and responsibilities for both. Among other things, the bill would:

- Require landlords to provide to every tenant information about bed bugs and the rights and responsibilities of both landlords and tenants.

- Prohibit tenants from bringing items known to be infested into the unit. Mandate that tenants report any suspected infestations within seven days.

- Require a landlord to retain services of a pest control operator within three days of notification.

- Require a landlord, if an infestation is confirmed, to provide notice to tenants within 48 hours and contract with a pest control operator to prepare and implement a bed bug treatment program within a reasonable time.

- Protect tenants from landlord retaliation if tenants report a bed bug infestation.

- Make tenants responsible for preparing their units as directed by a hired pest control operator.

- Keep the property subject to a bed bug management plan, once bed bugs have been controlled.

- Prescribe requirements for the disposal of items infested by bed bugs.
Upwards of 45 disease pathogens have been reported in bed bugs.

Possibly competent vectors for pathogens, such as:

- *Bartonella quintana* (trench fever)
- *Trypanosoma cruzi* (Chagas disease)

However, public health reports have thus far failed to produce evidence that infectious disease outbreaks have been associated with bed bugs.
<table>
<thead>
<tr>
<th>Authors</th>
<th>Year</th>
<th>Study type</th>
<th>Genus/species</th>
<th>Pathogen(s)</th>
<th>Clinical/laboratory significant findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leuhtti et al. [23, 24]</td>
<td>2015</td>
<td>Experimental</td>
<td><em>C. lectularius</em></td>
<td><em>Bartonella quintana</em></td>
<td>Demonstrated for the first time that bed bugs can acquire and maintain <em>B. quintana</em> organisms for more than 2 weeks and then release viable <em>B. quintana</em> organisms into their feces. Researchers observed the transmission of the bacterium to bed bug eggs as well as to L1 and L2 larvae. Since the bacterium was found to be localized in the digestive tract and not in the ovary, the authors of this paper suggested that the transmission of the bacterium to bed bug progeny may, in fact, be due to vertical non-transovarial and or horizontal transmission.</td>
</tr>
<tr>
<td>Saenz et al. [16]</td>
<td>2013</td>
<td>Report/experimental</td>
<td><em>C. lectularius</em></td>
<td><em>Burkholderia multivorans</em></td>
<td>Five bed bugs from four different apartments of an elderly housing building in North Carolina contained DNA sequences that corresponded to <em>B. multivorans</em>, an important pathogen in nosocomial infections that was not previously linked to an arthropod vector.</td>
</tr>
<tr>
<td>Salazar et al. [17]</td>
<td>2015</td>
<td>Experimental</td>
<td><em>C. lectularius</em></td>
<td><em>Trypanosoma cruzi</em></td>
<td>Reported efficient and bidirectional transmission of <em>T. cruzi</em> between mice hosts and bed bugs in a laboratory environment through cohabitation and the application of feces to broken host skin.</td>
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<tr>
<td>Goddard et al. [19]</td>
<td>2012</td>
<td>Experimental</td>
<td><em>C. lectularius</em></td>
<td><em>Rickettsia parkeri</em></td>
<td>Two adult bed bugs were IFA and PCR positive for rickettsia-like organisms. These results indicate that remnants of <em>R. parkeri</em> survive in the bed bugs for 2 weeks, but the viability of the organisms in these two specimens could not be determined.</td>
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<tr>
<td>Mayans et al. [28]</td>
<td>1994</td>
<td>Intervention</td>
<td><em>C. lectularius</em></td>
<td>HBV</td>
<td>Insecticide spraying of the child's dwelling was highly effective for reducing exposure to bed bugs, but there was no effect on HBV infection.</td>
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<tr>
<td>Blow et al. [6]</td>
<td>2001</td>
<td>Experimental</td>
<td><em>C. lectularius</em></td>
<td>HBV</td>
<td>HBV was passed transstadially through one molt, was shed in fecal droplets for up to 35 days after the infectious blood meal, but was not passed transovarially.</td>
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<tr>
<td>Silverman et al. [40]</td>
<td>2001</td>
<td>Experimental</td>
<td><em>C. lectularius</em></td>
<td>HBV, HCV</td>
<td>Bed bugs and their excrement remained HBV DNA-positive throughout 54 days of testing. No HCV RNA was detected in bed bugs after feeding on an infectious meal.</td>
</tr>
<tr>
<td>Barbarin et al. [5]</td>
<td>2014</td>
<td>Experimental</td>
<td><em>C. lectularius</em></td>
<td>MRSA</td>
<td>Results indicated that while the bed bug midgut is a hospitable environment for MRSA, the bacterium does not survive for longer than 9 days within the midgut, which suggests that bed bug transmission of MRSA is highly unlikely.</td>
</tr>
<tr>
<td>Cockburn et al. [8]</td>
<td>2013</td>
<td>Experimental</td>
<td><em>C. lectularius</em></td>
<td>Non-pathogenic skin bacteria</td>
<td>Bacteria found commonly on human skin are closely associated with bed bugs and do not pose a risk to human health.</td>
</tr>
<tr>
<td>Reinhardt et al. [24]</td>
<td>2005</td>
<td>Experimental</td>
<td><em>C. lectularius</em></td>
<td><em>Penicillium chrysogenum, Stenotrophomonas maltophilia, Enterobacter hormaechei, Bacillus licheniformis, Staphylococcus saprophyticus</em></td>
<td>No microbes were isolated from the piercing and sucking mouthparts. Consequently, the epidemiological significance of bed bugs carrying externally attached microbes is likely minimal.</td>
</tr>
</tbody>
</table>

For a comprehensive list of all published original articles with bed bugs as potential vectors of infectious disease, please refer to these references [13, 48]

HBV hepatitis B virus, HCV hepatitis C virus, IFA immunofluorescence assays, MRSA methicillin-resistant *Staphylococcus aureus*, PCR polymerase chain reaction, VRE vancomycin-resistant *Enterococcus*
Joint Statement on Bed Bug Control in the U.S. from the CDC and EPA:

“Although bed bugs are not known to transmit disease, they are a pest of significant public health importance.”

“The public, together with their local health agencies, must be involved in the control and management of bed bug populations... In some cases, a coordinated community control program may be necessary to reduce or eliminate bed bug populations.”

* 45 human pathogens detected in bed bugs

November 22, 2010
IT IS POSSIBLE TO HAVE BED BUGS AND NOT KNOW IT!

- Bed bugs are most active at night, in the dark.
- Light tends to repel them.
- Most people never feel bed bugs bite.
- It only takes from 3-10 minutes for them to take a meal, and then they fall off the host and crawl away to hide, digest, grow, mate…
- Some people do not react to the bites…
- Some people cannot see them due to their small size.
Bed Bug Detection

• How do you find bed bugs?
  – Visual Inspections
  – Detection Equipment
  – Canine Inspections

• How to verify control and elimination of bed bugs?
Passive Detectors

- Climb-up
- Glue boards

Slide courtesy of Western Exterminator
Climb-ups

Sticky Traps
Climb-Ups & Encasements

- Encasements “take away” the bed and box spring as harborage and make the bugs stand out.
- Climb-Ups prevent all “bridges” to the bed. The person is the bait.

Slide courtesy of Western Exterminator

www.bedbugcentral.com
BED BUGS AND THEIR WASTE IN SOFA SEAM
A bed bug expels ½ the blood meal out of its anus on way back to hiding place
Mattress/Box Spring

Blood Spots

Bed Bugs in Mattress Folds
Nightstands/Furniture

Bed bugs hidden beside a recessed screw under a nightstand.
Behind Pictures Hanging Near Bed Or Headboard
Bed Bug Spotting/Smearing On Wall
Signs of a Bed Bug Infestation

Bed Bug
Skin Castings
Bed Bug Eggs
Bed Bug Fecal Material
Bed Bugs
• 53% of apartments adjacent to infested apts were also infested.
• 15% of residents declined inspection saying they did not have bed bugs.

# Pest Sighting Log

<table>
<thead>
<tr>
<th>Filled out by employees</th>
<th>Filled out by Pest Control Officer (PCO)</th>
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Instructions: Place this log in a conspicuous place. Encourage employees to write in pest sightings. This includes feces, chewing signs, etc. Your Pest Control Officer should work from this list to apply treatments or discuss prevention methods to minimize pests.

Supervisor Review: ___________________________ Date: ___________________________
Preventing Bed Bug Introduction

• Prevention of introducing bed bugs or other ectoparasites can save money and aggravation.
• May take more than available time.
• Maybe, people come in first and personal items in quarantine for inspection and possible treatment.
Treatment area of 38x38x26 inch
HOT SHOT

BEDBUG
MATTRESS & LUGGAGE TREATMENT KIT

INCLUDES
- Pest Strip
- Scalable Treatment Bag

GUARANTEED WORK OR YOUR MONEY BACK!

TREATS OTHER HOUSEHOLD ITEMS

TREATMENT
- Large bag holds & treats up to a king size mattress
- Treats non-washable items
- Also use to seal & dispose of infested items

KILLS BED BUGS & BED BUG EGGS

For use on Bed Bug and bed bug eggs.

WARNING
- Keep out of reach of children.
- Not recommended for use on mattresses.

CONTAINS 1 (9.56 oz) Strip NET WT 0.56 oz (16 g)
Treatment Options?

- Chemical
- Physical
  - Heat: 130°F. and Hand Steamers
  - Cold: several days at 0°F and a week at 20°F.
- Integrated Bed Bug Management that combines a variety of approaches
MOST EFFECTIVE AREAS TO APPLY KILLS BEDBUGS PRODUCTS

- Apply JT EATON KILLS BEDBUGS and CRAWLING INSECTS POWDER Around Switches And Outlets.
- DO NOT SPRAY ANY LIQUID PRODUCTS INTO THESE AREAS.
- Spray Behind Mirrors And Where Mirror Is Set In Frame (Where Applicable).
- Remove Drawers And Spray Drawer Slides And Under Drawers. Spray All Wood Joints And Behind Furniture And Beds.
- Spray Behind Picture Frames.
- Check Clocks, Lamps, etc. For Bedbugs. Do Not Spray Any Liquids Into Any Electrical Fixtures. Do Not Spray Inside Clock Works.
- Spray Behind Window Molding.
- Spray Along And Behind Baseboards.
- In the Summer Months, When Heat Is Off, Spray In And Behind Registers With Steam Heat.
- Do Not Spray Liquid Insecticides Into Electric Space Heaters.
- Spray Under Rugs And Under Beds.
- Remove Mattress And Spray Concentrating On All Folds, Tufts and Edging. Also Spray Boxspring. If Possible Place Mattress In Sealable Mattress Size Plastic Bag After Spray Has Dried. Spray Floor Under Bed.
- Remove Drawers And Spray Drawer Slides And Under Drawers. Spray All Wood Joints And Behind All Cabinets.
- Apply JT EATON KILLS BEDBUGS and CRAWLING INSECTS POWDER Around Switches And Outlets.
- DO NOT SPRAY ANY LIQUID PRODUCTS INTO THESE AREAS.
Heat Treatment Equipment
Have you been bitten?

- An individual’s reaction to an insect bite is based on their immune response...
  - Individuals react differently
- Repeated exposure to external allergens can lead to skin reactions
- Sensitivity decreases with age and exposure
Have you been bitten?

- 50% of residents with bed bugs, did not know they had them.
- Orkin Training Center: 900 Volunteers after 18 days <5% had a reaction.
- 7 volunteers with no reaction after two weeks, were re-bitten & reacted 6-11 days, 4 re-bitten 1.5-3 days.
- 1 volunteer 3-bites no reaction.

Harrison, Pulling Back the Sheets on the Bed Bug Controversy ...
Typical Bite Reaction

- Usually a localized red swelling.
  - Welts and localized inflammation are due to allergic reactions to saliva injected during feeding.
  - Antibiotic creams can prevent infection when applied to a bed bug bite.
  - Anti-itch creams may help with itching and tendency to want to scratch.
If you think that you have bed bugs?

• Tell the building manager so they can start working on the problem right away
• Talk with your neighbors
• Capture one (ID)
• Be cautious about what you bring out and into your unit
• Do not over react!
Other Than a Bed Bug?

What’s biting me?

- Fleas
- Mosquitoes
- Mites
  - Scabies
  - Rodent or Bird Mites
- Lice
- Morgellons/DP

Most arthropod bites are difficult for an MD to diagnose!
Delusions of Parasitosis: Formication

- Formication is a symptom where you hallucinate the feeling of insects crawling in, on or underneath your skin.
- This symptom has many possible causes, including mental health disorders, medical conditions and more.
- This symptom is often treatable, with available treatments depending on the cause and other factors.

- Antipsychotics are useful for treating both primary and secondary formication.
- The medication pimozide (Orap) was once preferred.
- But newer antipsychotics, such as risperidone (Risperdal) or olanzapine (Zyprexa), are now favored because they work better.
Lice

Lice are parasitic insects that can be found on people's heads and bodies. They survive by feeding on human blood. Lice found on each area of the body are different from each other. The three types of lice that live on humans are head lice, body lice (also called clothes lice), and pubic lice ("crabs").

- **Body Lice**
  Body lice are tiny insects (scientific name is *Pediculus humanus corporis*) that are spread through close contact with other people.

- **Crab Lice**
  Pubic lice are tiny insects that infect the pubic hair area and lay eggs there. These lice can also be found in armpit hair and eyebrows.

- **Head Lice**
  Head lice are tiny insects that live on the skin covering the top of your head (scalp). Head lice may also be found in eyebrows and eyelashes. Lice can be spread by close contact with other people.
Lice Feeding

View Video Here
Life Cycle of the Body Louse
*Pediculus humanus*

- **Eggs** (1.0 mm)
- **First Stage Larva** (1.5 mm)
- **Second Stage Larva** (1.75 mm)
- **Third Stage Larva** (2.0 mm)
- **Adult**
  - (Female: 2.4 - 3.6 mm)
  - (Male: 2.3 - 3.0 mm)

**Note:** Lice take several blood meals daily in larval stages and as adults.
Adult body louse and head lice

A. Ventral view of slide mounted female head louse

B. Ventral view of slide-mounted male body louse

C. Dorsal view of ethanol-preserved female head louse

D. Dorsal view of ethanol-preserved male head louse.
The female body louse can deposit 8 eggs per day. Both nymphs and adults feed on blood several times a day, injecting irritating saliva into the wound causing intense itching.

The entire life cycle requires about 21 to 27 days.

The adult body louse can survive no longer than eight to ten days off the host, and all stages, including eggs, die within 30 days away from the host.

Under normal conditions, the eggs will hatch in about a week. Below 74 degrees F, most eggs will not hatch.

Newly hatched nymphs must feed within 24 hours or die.

Adults may survive 3 to 5 days without a blood meal. Normally a young louse will mature to an adult in 3 to 5 weeks.
Relapsing Fever: generalized body aches, headache, chills sweats, vomiting, photophobia, rash, neck pain, dry cough, and dizziness.

Typhus: severe headache, chills, high fever, stupor, skin rash, muscle aches, swollen and lymph nodes.

Trench Fever: The onset of symptoms is usually sudden, with high fever, severe headache, pain on moving the eyeballs, soreness of the muscles of the legs and back, and frequently hyperesthesia of the shins.

Scabies is not an infection, but an infestation. Tiny mites called *Sarcoptes scabiei* set up shop in the outer layers of human skin. As the mites burrow, feed, defecate and lay eggs inside the skin, the infestation leads to constant itching and a significant red rash.

**Diagnosis:** Skin scraping and microscope identification of mite parts
Scabies Treatment

- Topical or oral prescription medications:
  - Elimite topical permethrin
  - Ivermectin oral antiparasitic drug (maybe off label)
- Sanitation/Environmental
  - Laundering of clothing and bedding
- Mites only survive 2-3 days off of host
Common Fleas
(over 300 sp. In US)

• Cat Flea
  - Transmits: Flea-borne (murine typhus) and cat scratch disease (CSD)
  - Comments: Despite the name “cat flea”, this flea is the most common flea found on pets (including dogs) and other domestic animals in the United States. It is capable of spreading plague bacteria, but does so inefficiently compared with ground squirrel or rat fleas.

• Dog Flea (Ctenocephalides canis)
  - Transmits: Aids in spreading Dipylidium caninum, a tapeworm commonly found in dogs and cats, but occasionally found in humans.
  - Comments: Despite the name, the dog flea is not a common flea of the domestic dog in the United States.

• Ground Squirrel Flea (Oropsylla montana)
  - Transmits: Plague
  - Comments: Frequently associated with ground squirrels, including California ground squirrels and rock squirrels, which are known to aid in the spread of plague bacteria to people in the United States.

• Oriental Rat Flea (Xenopsylla cheopis)
  - Transmits: Plague and flea-borne (murine typhus)
  - Comments: A rat associated flea commonly known for transmitting plague bacteria globally.
The diagram illustrates the lifecycle stages of fleas, including:

- **Adults**: 5%
- **Pupae**: 10%
- **Larvae**: 35%
- **Eggs**: 50%

These stages are represented in a pyramid sequence, indicating the percentage of each stage in the lifecycle.
Flea-borne Diseases of the United States

- **Plague** — most commonly transmitted to humans in the United States by infected ground squirrel fleas, and globally by infected Oriental rat fleas. Most U.S. cases occur in rural areas of the western United States.

- **Flea-borne (murine) typhus** — transmitted to people by infected cat fleas, infected Oriental rat fleas, or their feces. Most cases in the United States are reported from California, Texas, and Hawaii.

- **Cat scratch disease (CSD)** — transmitted to humans most often after a scratch from a domestic or feral cat that has been infected by a cat flea, or through flea feces being inoculated through a cat scratch.

- **Flea-borne parasites**, such as tapeworms can spread to people and animals if they accidentally swallow an infected flea.
Flea Control

- Remove or treat flea host
  - Pet flea control
  - Wildlife exclusion
- Vacuum premises frequently
  - Flea traps
- Exterior Control
  - Chemical control
German Cockroach Infestation
• Travel light—bring only what you need to accomplish your mission, and personal items can be left locked in the trunk of your car.

• You can bring your own chair/table to avoid placing items on the clients’ floor, or furniture.

• It is a good practice to explain that the reason you bring your own chair is that you do not want to bring bugs into their home, from another client’s home and that you clean your equipment every day, and inspect between visits.
Ectoparasite Exposure Precautions

• Your work chair can be kept in a durable sealable plastic bag.

• When visiting a client, try to position yourself in the middle of the floor/room, well away from furniture.

• Kitchen tables may be safe (cockroaches).

• Learn the signs of infestation and be observant—when in doubt get expert advice.
- Check weight load of Chair
- Check weight load of table
- Clean-ability
- Ease of opening and closing
- Simple and functional

Folded dimensions: 33L x 5W x 21H inches
REPELLENTS

TOPICAL FOR SKIN
FOR CLOTHING

Remember: Always follow product label directions!
Alameda County Vector Control
Homeless Encampments and Disease Surveillance
Rodent Requests For Service 2006-2021 Compared

- Unclassified Rats
- Roof Rats
- House Mice
- Various Rodents
- Norway Rats
- Yearly Total
We trap and control Norway rats at some of the larger camps within the city.

The encampments that we target are based on level of rat activity.

These tend to be encampments that have existed for an extended period of time.

2020
Diseases Associated with Rats

2009 Review paper found numerous diseases associated with rats:

- 20 Viral
- 19 Bacterial
- 6 Protozoa
- 16 Helminths

The most common:

- Leptospirosis
- Murine Typhus
- Rat Bite Fever
- Cryptosporidiosis
- Salmonellosis
- Seoul Virus
Integrated Vector Management

- Sanitation = Food and Water Deprivation
- Rodent Proofing = Shelter Deprivation/Habitat Modification
- Community Education
- Direct Control = Trapping, Rodenticides
- Sewer Based Rat Control
Close Attention To The Areas Of Your Home Depicted Here, Will Help Prevent A Rat Problem On Your Property.

- Open up or remove double fencing.
- Check garage shelves and storage lofts for rat evidence.
- Keep garden sheds and shelters tightly closed, check periodically for rat evidence.
- Keep all garbage cans covered.
- Restrict bird feeding to a cleanable area.
- Feed your pet only the amount of food it will eat.
- Screen or close openings under overlapping roof lines.
- Repair damaged ventilation screens.
- Seal all openings around pipes, cables, and wires that enter walls and foundations.
- Provide a tight fitting cover for crawl space.
- Harvest and pick up dropped fruit and nuts.
- Thin or remove dense vegetation.
- Thin ivy.
- Pick up dog droppings.
- Do not accumulate trash.
Sewer rats can burrow up 8 ft. or more through solid ground, or enter homes and property through open sewer hoppers, holes in basements or uncapped sewers.
* Screen vents, holes, and overlapping roof with 16 or 20 gauge 1/4 inch hardware cloth.

* Use sheet metal collars around pipe entrances on wooden walls.

* Use cement fill around pipe in brick, stone, or stucco walls.

* Use sheet metal edging along door bottoms to prevent entry and gnawing by rats.
Rat Zapper
Battle Station

Catch-all type mouse trap
Acknowledgements

- Robert Gay, Chief, Vector Control District
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