



Version 2.2

In this module emphasize that keeping a home pest-free is important, but care must be taken not to cause exposure to dangerous pesticides.

This is our 3<sup>rd</sup> "Keep It" – we have already looked at KEEP IT DRY and KEEP IT CLEAN.

**LEARNING OBJECTIVES**


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Name three illnesses or injuries associated with pest infestation.

Identify three clues of pest infestation.

Identify the three strategies associated with an IPM approach.

Name two illegal pesticides that may be used in the home.



Key IPM Messages:

## Reduce risk

Reduce pesticide use  
Choose pesticides carefully

## Use an integrated approach

Use multiple tools to get effective control

## Take preventive measures

Clean up food, water and places to hide (harborage)



**HEALTH EFFECTS OF PESTS**

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6.1

- Asthma
- Infectious diseases
- Health effects greater on children

#### Asthma

Rate doubled in 20 years (now 10%+)

Main cause of lost school days

Main trigger in urban areas is pests

Spread infectious diseases

Health effects greater on children

It is the health effects that are the main drivers for our concern about pests, and asthma tops that list. The asthma rate has doubled in the last 20 years, and is now over 10% of school age children nationwide; in many urban areas it is twice the national average! Asthma is the main cause of lost school days, which also means lost work days, since a parent must stay home with the sick child!

Cockroaches and mice have been identified as the major triggers for asthma in urban areas (in the suburbs it's cats and dogs). In addition most homes have dust mites – all excrete potent allergens that can cause allergic (atopic) effects, and trigger asthma attacks. This means that not only do we have to eliminate the pests, but we have to remove them, and clean up their mess!

Pests are capable of spreading infectious disease – both roaches and rodents can carry dozens of infectious bacteria, viruses, and even fungi. Mice are a reservoir for, and can vector, salmonella.


Children are the most vulnerable population – they are smaller, so smaller amounts can have health effects. Children also eat more, drink more, and breathe more, pound for pound, than adults. And, since they are growing, and critical body systems are still developing, “insults” to their bodies may have more profound effects.

## HEALTH EFFECTS OF PESTS

- Exposure to Pest Allergens

Pest	Pathway	Allergen
Dust Mite	Feces	Der p 1
Cockroaches	Feces	Bla g 1 & 2
Mice	Urine	MUP

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**Pest Allergens**

Exposure to pest allergens from cockroaches, dust mites, and rodents can cause serious allergic and asthmatic reactions. Children are particularly susceptible. Exposure to these allergens at a young age — even in the womb — can increase babies’ and children’s risk of developing of asthma, respiratory symptoms such as wheezing and coughing, eczema, and allergies. It is critical to minimize pregnant women’s and children’s exposure to allergens in order to lower the risk of allergy, asthma, and respiratory symptoms

**HEALTH EFFECTS OF PESTS**

Page 6.2

- Bites
- Common Culprits
- Rabies



*Mosquito bites*



Frequency: <http://emedicine.medscape.com/article/768875-overview#a0199> 7/6/11

Photo: emj.bmj.org

Bites

Piercing the skin barrier

Common Culprits

Mosquitoes

Ticks

Bedbugs,

Flies



Rats

Rabies

**HEALTH EFFECTS OF PESTS**

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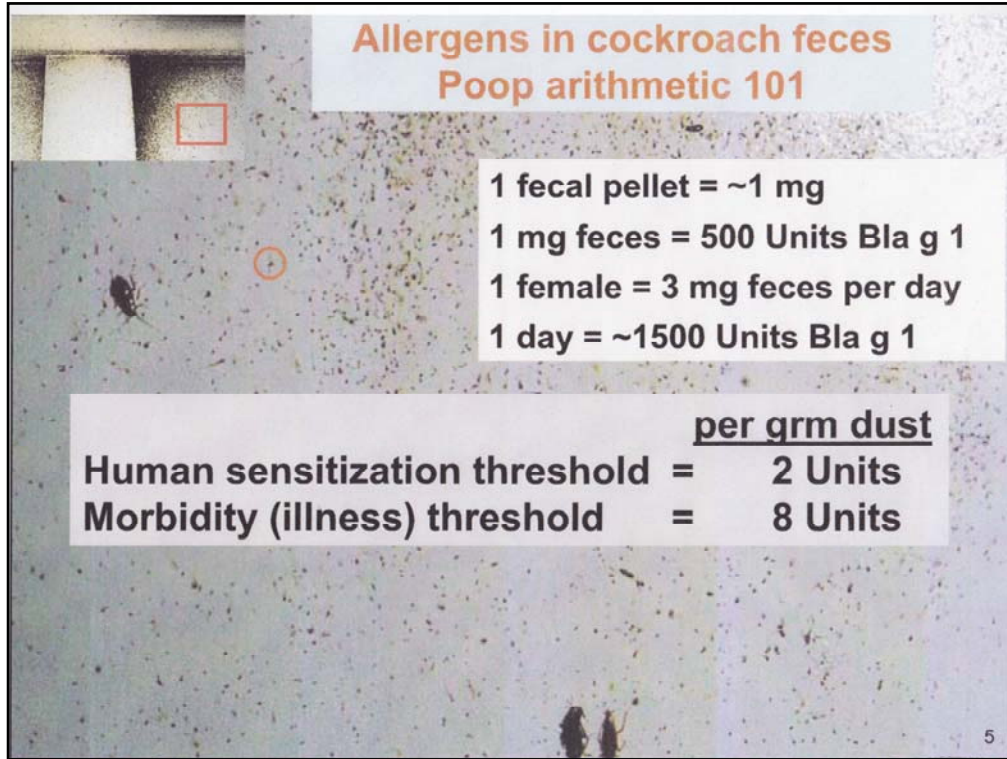
- Rat Bites



Frequency: <http://emedicine.medscape.com/article/768875-overview#a0199> 7/6/11  
Photo: emj.bmj.org

## Rat Bites

fewer than in '70's  
Up to 500,000 rodent bites/yr  
Mostly sleeping infants  
Food residues  
Rat Bite Fever (>10%  
mortality)



**Allergens in cockroach feces**  
**Poop arithmetic 101**

1 fecal pellet = ~1 mg  
 1 mg feces = 500 Units Bla g 1  
 1 female = 3 mg feces per day  
 1 day = ~1500 Units Bla g 1

per grm dust  
 Human sensitization threshold = 2 Units  
 Morbidity (illness) threshold = 8 Units

5

The main photo is an enlarged detail of the upper left hand corner showing the inside back of a cabinet; the 'dots' are "FRASS:" insect poop, specifically cockroach feces.

Bottom line: each female (females are bigger, eat more & poop more, and expression of the allergen is linked to the reproductive cycle), can potentially trigger about 180 asthma attacks.

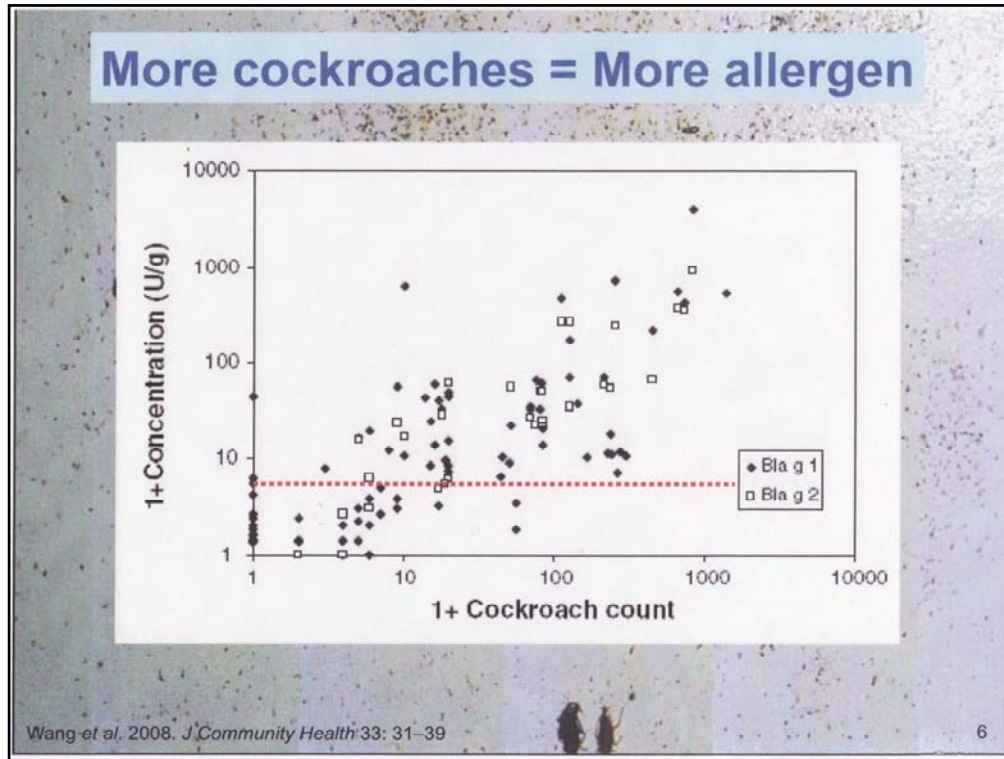
**The ABC's of Indoor Health:**  
**Allergens, Baits, Cockroaches**

A Tale of Cockroach IPM in 2 Environments

Coby Schal  
 Department of Entomology  
**NC State University**  
 Raleigh, NC  
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2008 Translating Healthy Homes Research

1



The slide is from Changlu Wang, a leading urban entomologist now at Rutgers. The relationship between number of bugs (bottom) to concentration of allergen (left) is basically straight-line. The 8-unit morbidity threshold is the red line: IF you have fewer than 10 cockroaches, allergen levels are sub-clinical.

Do you know residents who have roaches, who have fewer than 10???

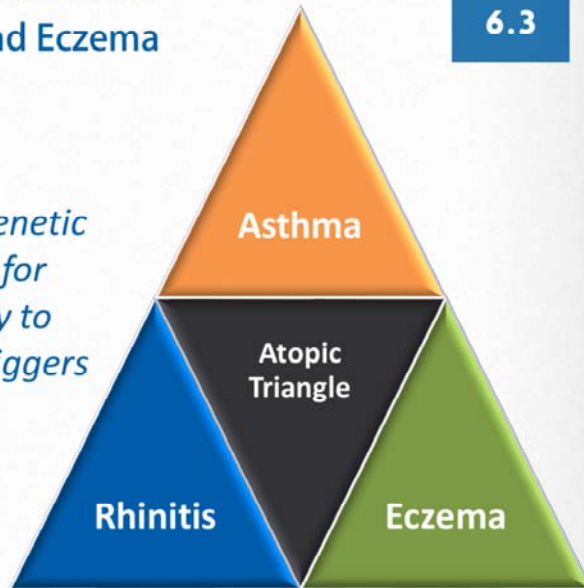


# THE ATOPIC TRIANGLE

Asthma, Allergies and Eczema

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**Atopic:**  
*pertaining to a genetic  
predisposition for  
hypersensitivity to  
environmental triggers*



Introduce the concept of the Atopic Triangle

**THE ATOPIC TRIANGLE**  
Asthma, Allergies and Eczema

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- Pests
- Immunoglobulin E (IgE) producing conditions
- Conditions interact/trigger; commonly coexist
- Environmental conditions trump genetics
- Hygiene hypothesis

Allergens are part of the “Atopic Triangle,” including Asthma & Eczema – all three are often (but not always) found together, and can cross-react. They are all produced by protein interaction with IgE (as are food & other true allergies. Non-proteins *may* have toxic effects, but are not true allergies).

•Pests

- often cause allergies
- trigger other “atopic” (environmental) responses

•Immunoglobulin E (IgE) producing conditions

- Asthma
- Chronic rhinitis
- Atopic dermatitis
- Food allergies
- Other allergies

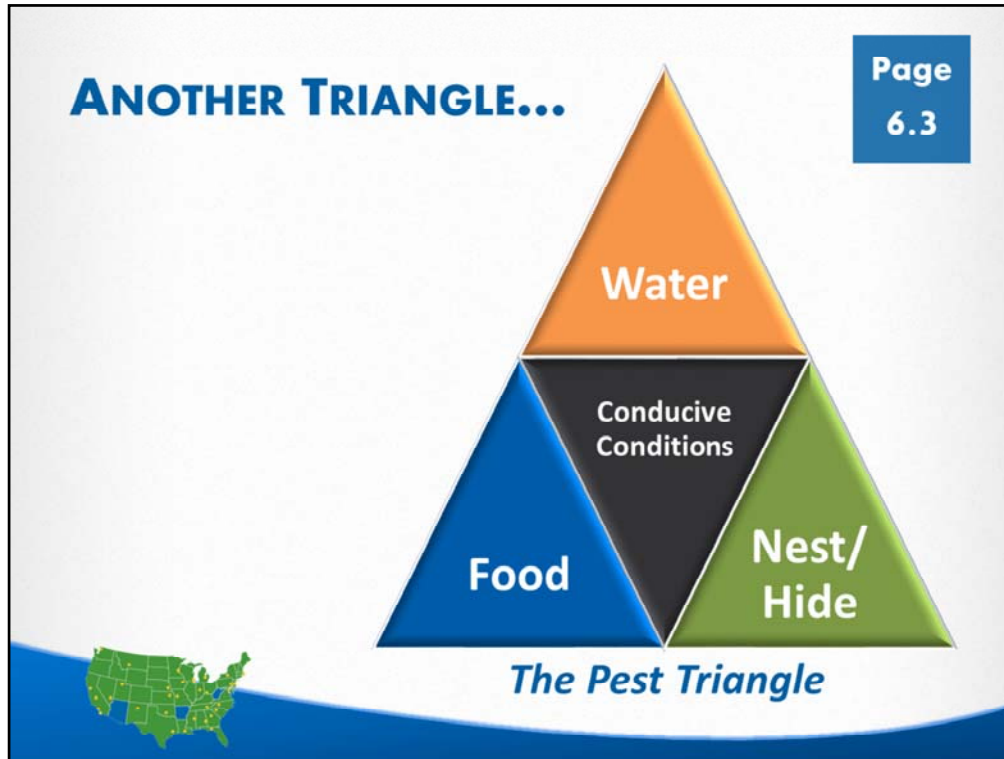
Conditions interact/trigger; commonly coexist

Although genetic predisposition is part of atopy, environmental exposure seems to be more important.

The Hygiene Hypothesis is a controversial concept with much evidence to support it: because we have largely eliminated dirt, pathogens and exposure to many irritants in our environment, children do not develop appropriate immune responses as infants. Instead, when they encounter “insults” as older children they become sensitized and develop atopic symptoms.

However, there is no understanding of what actually *causes* asthma. As the IOM report indicates, factors that contribute to the development of asthma have been identified (Q: What are they? A: House dust mites & exposure to ETS *in pre-school age children*), and many triggers of asthma have been identified (Q: What are they? A: House dust mites & exposure to ETS *in pre-school age children*; cats & dogs (primary triggers in *suburban* areas); cockroaches and mice [**mice have been identified as asthma triggers since the IOM report**] (primary triggers in *urban* areas); molds and other fungi, rhinoviruses, & nitrogen oxides *in high concentrations*). *BUT – the underlying causes of asthma remain unknown.*

Gern, JE, and WW Busse, *Contemporary Diagnosis and Management of Allergic Diseases and Asthma*, 5e. 2008:Newtown PA, Handbooks in Healthcare Co. p.5ff.



ALL pests need three things: food, water and a place to hide (harborage). Preventing, or removing these **conditions conducive to infestation** will prevent pests – they will go to where food, water and harborage *are* available.

## The Pest Triangle

Food

Water

Harborage

- ❖ Somewhere to hide
- ❖ Somewhere to nest
- ❖ Ideally warm

This is the essential concept behind IPM – remove the conditions and you prevent the pests. If you take *one* concept away, this is what you need to know.

## HOW COMMON ARE PESTS?

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### American Housing Survey (2011)

#### All Housing

- 1.0% Rats
- 11.1% Mice
- 0.6% Rodents, unsure of type

#### Below Poverty

- 1.8% Rats
- 12.5% Mice
- 1.0% Rodents, unsure of type



*Rat feces in insulation*



## How COMMON ARE PESTS?

- Philadelphia, 2007
  - ◆ 62% Cockroaches
  - ◆ 72% Mice
  
- National 2002-2006
  - ◆ 33% Rat allergens (inner-city)
  - ◆ 63% Mice allergens
    - (95% low-income)
  - ◆ 85% Cockroach allergens

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6.4





Community Asthma Prevention Program  
(Philadelphia, 2007)  
62% Cockroaches  
72% Mice

National Allergy & Asthma  
Surveys (2002-2006)  
33% Rat allergens (inner-city)  
63% Mice allergens  
➤ (95% low-income)  
85% Cockroach allergens

Citations for allergy and asthma surveys:

Cohn, R. D., Arbes, S. J., Jr., Jaramillo, R., Reid, L. H., & Zeldin, D. C. (2006). National prevalence and exposure risk for cockroach allergen in U.S. households. *Environ Health Perspect*, 114(4), 522-526. Retrieved from [http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Citation&list\\_uids=16581539](http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Citation&list_uids=16581539)

Cohn, R. D., Arbes, S. J., Yin, M., Jaramillo, R., & Zeldin, D. C. (2004). National prevalence and exposure risk for mouse allergen in US households. *Journal of Allergy and Clinical Immunology*, 113(6), 5.

**Page**  
**6.4**

## HOW DO WE CONTROL THEM?

- Prevention
- Sanitation
- Physical controls
- Ongoing monitoring

<p><b>This is a winged ANT</b></p> <p>Elbowed antennae</p> <p>Narrow waist</p> <p>Front wings longer than back wings</p> <p>Actual size 1/2-inch</p>	<p><b>This is a winged TERMITE</b></p> <p>Straight antennae</p> <p>Thick waist</p> <p>Both pairs of wings same size</p> <p>Actual size 1/2-inch</p>
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Control measures in IPM - beyond prevention – include these factors. Proper identification is essential – you need to know what the pest is in order to know if it is a critical pest, and how to control it. For instance, termites require different – and much more extensive controls – than ants. Assuming that ants are “termites” can lead to the unnecessary application of, and exposure to high toxicity pesticides. ***Know your pest before you start!***

Other basic control principle in IPM are:

- Exclusion & Denial – keeping them out of a home, and sealing their harborages
- Sanitation – remove **all** food residues, filth, clutter and other food and protection
- Water – most pests need a source of water; cockroaches, for instance, can live a month without food, but only a week without water. *But*, mice do not need to drink – they get the water they need from their food, They will however, drink free water if its available. Bedbugs also do not water – what do they drink? (**A:** Blood)
- Physical controls – include traps of all sorts – glue traps, pheromone-lures, snap traps, curiosity traps, etc
- Chemical controls – are not the first choice of tool, and low risk pesticides, including cockroach baits and gel, boric acid, and insect growth regulators (IGR). Other pesticides *maybe* used if essential, but rarely.
- Ongoing monitoring – is essential after control is established, in order to know if pests are reintroduced, so that new controls can be used before an infestation is reestablished.

## INTEGRATED PEST MANAGEMENT

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6.5

- Best practice
- Multiple tactics
- Effective control
- Least risk to the environment
- Least exposure of non-target organisms
- Economic sustainability

The diagram illustrates the IPM cycle. At the center is 'IPM'. Three main components are arranged in a circle, connected by arrows: 'Education/Training' (top-left), 'Eliminate/Reduce' (top-right), and 'Control Measures' (bottom). 'Education/Training' includes Management, Contractors, Tenants, and Other Employees. 'Eliminate/Reduce' includes Food source, Water, Harborage, and Pest Access. 'Control Measures' includes Non Chemical, Prevention, and Chemical. Arrows indicate a clockwise flow from Education/Training to Eliminate/Reduce, then to Control Measures, and back to Education/Training.

So – what *is* IPM? First, it is important to realize that Integrated Pest Management is considered *THE* best practice for pest control by HUD, EPA, CDC, the National Pest Management Association, and most academic researchers. It is *not* “new,” unproven, radical, or trivial. HUD and the Government Services Administration have implemented IPM since 1995; the National Park Service since the 1980’s. IPM should *not* be considered a “premium” service, marketed at a higher price point to pesticide-adverse residents, as some commercial pest controllers persist in.

Multiple tactics is one of the key elements of IPM: many tools are available and should be used, not reliance on a single method. Pesticides for instance, are *one* tool in the IPM tool box. Just like you do not use a hammer for every fixit job – do you use a hammer to drive a screw, or loosen a stuck glass window? – pesticides are not the only, or primary tool in the IPM toolbox.

However, effective control is the essential goal: methods that do not provide effective control – such as using glue boards as the only method for pest control in a school, are inadequate. Again, *multiple methods* are usually necessary to eliminate pests.

At the same time, it is important to not affect “non-target organisms” – children, adults, pets, wildlife etc.


It’s also important that control methods be economically sustainable – controls need to be maintained over time, and costs *are* a significant factor and need to be considered. Further, control measures should have minimal environmental impact for long-term sustainability (for instance, disposable traps should perhaps be paper or wood, not plastic).


## REDUCE PESTICIDE USE

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Pest pressure can drive people to unsafe use of pesticides.

- Too much
- Too many
- Wrong kind – unsafe & Illegal





See: **Pesticide use & Risks**

nToo much

– *acute effects* like poisoning, especially *children!*

nToo many

– *chronic effects* like long term residues

nWrong kind – unsafe & Illegal pesticides – *Tres pasitos*; Chinese chalk

One of the elements of IPM is a *reduced* used of pesticides. IPM does not exclude the use of pesticides, but the use of the other tactics reduces the *need* for pesticides. IPM also makes deliberate choices about the types of pesticides when they must be used, and makes least risky choices.

This is in contrast to conventional controls, particularly those most familiar to residents – aerosol sprays and foggers, and baseboard sprays by pest control operators (PCO's). Infestations drive residents to use pesticides in ways and amounts that risk compromising their health, particularly of their children.

Using too much pesticide (a common problem is using multiple foggers in a small apartment!) can result in *acute* exposure – pesticide poisoning. In 2007, Poison Control Centers reported 16,000 pesticide exposures requiring treatment, over half to children under 5 years old. 93% of these exposures occurred in their own home.

Much less understood are *chronic* exposures: the effects of exposure to small amounts of pesticide over a long time. Most pesticides leave residues that persist in homes indefinitely. Studies in Boston and New York City, for instance have found DDT residues still in homes, 30 years after it was banned in this country. We simply do not know what effect on children's health these exposures may have.

High levels of pests may also lead people to use dangerous or illegal pesticides – “Tres pasitos” is common in Latino communities. It is manufactured overseas and illegally imported. Commonly sold in baggies in *bodegas* (neighborhood stores) or on the street, it is used to poison mice: “Tres pasitos” means “three little steps” – that's as far as the mouse gets after eating it. There is actually a thriving black market in pesticides in this country – many people miss the old, now-banned pesticides – they “worked better” than those now available. However, they have very high risks associated with them. Chinese chalk is another product not registered with the EPA or legal for sale or use in this country. It is chalk impregnated with high-potency pesticide. You draw a line with it – when a bug walks across the line, it dies. But what happens when a kid uses it to draw a hopscotch grid and then puts her fingers in her mouth?



## PESTICIDES AND POISONINGS

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- 16,000 pesticide exposures requiring treatment reported (2007)
- Pesticides usually stored within reach of children
- 95% of children poisoned were under age 6



In 2007, Poison Control Centers reported 16,000 pesticide exposures requiring treatment

Almost half of all households with children under five stored pesticides within reach of children

95% of all poisoning of children under age 6 occurred in their own home

The American Association of Poison Control Centers reported 113,000 cases of pesticide poisonings. <sup>[2]</sup> Surprisingly, it is estimated that this figure represents only 1/4 to 1/3 of the total since most incidents were not reported to their registry.

2007 Annual Report of the American Association of Poison Control Centers' National Poison Data System: 25th Annual Report (17301), [www.cdc.gov/mmwr/preview/mmwrhtml/mm5650a1.htm?s\\_cid=mm5650a1\\_e](http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5650a1.htm?s_cid=mm5650a1_e). There were 96,307 pesticide exposures – 44,644 involving children five years or younger. 15,965 exposures required treatment in a health-care facility.

In 1971, Mr. Yuk was created by the Pittsburgh Poison Center at Children's Hospital of Pittsburgh. Since then, Mr. Yuk has been used to educate children and adults about poison prevention and to promote poison center awareness. In addition, Mr. Yuk has raised awareness that poison centers are available 24 hours-a-day, every day of the year to assist in the management of poisoning emergencies. <sup>[3]</sup>

## THE IPM PYRAMID

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IPM is a process that balances the use of design, physical, biological and chemical controls to manage pests. Just like the food pyramid, the primary tools are lower on the pyramid; those higher up are used sparingly. In the IPM pyramid, lower risk interventions are lower down, and higher risks rise towards the top.

The base of the pyramid is building design, sanitation, and communication: building the pests out, and monitoring for their presence. Mechanical controls – traps, such as light traps, mechanical traps, pheromone lures, etc. are preferred control methods. In some cases biological controls may be useful: cats are often used to control mice. However, modern American house cats are too well fed, in most cases, to be effective at rodent control, and will be simply unable to eliminate an extensive infestation; they are better as a deterrent to a “pioneer” seeking new territory.


Finally pesticides are at the top of the pyramid, which may have two layers: “biorational” pesticides, and “conventional.” “Biorational” pesticides minimize exposure and may have reduced toxicity (such as cockroach bait “pucks” and gels, or IGR’s). Conventional pesticides largely rely on contact with the pest to poison it, and include aerosols, foggers and conventional sprays. They have the highest risk of exposure, and usually higher toxicity.

The best practice is to make decisions that utilize choices low on the pyramid.

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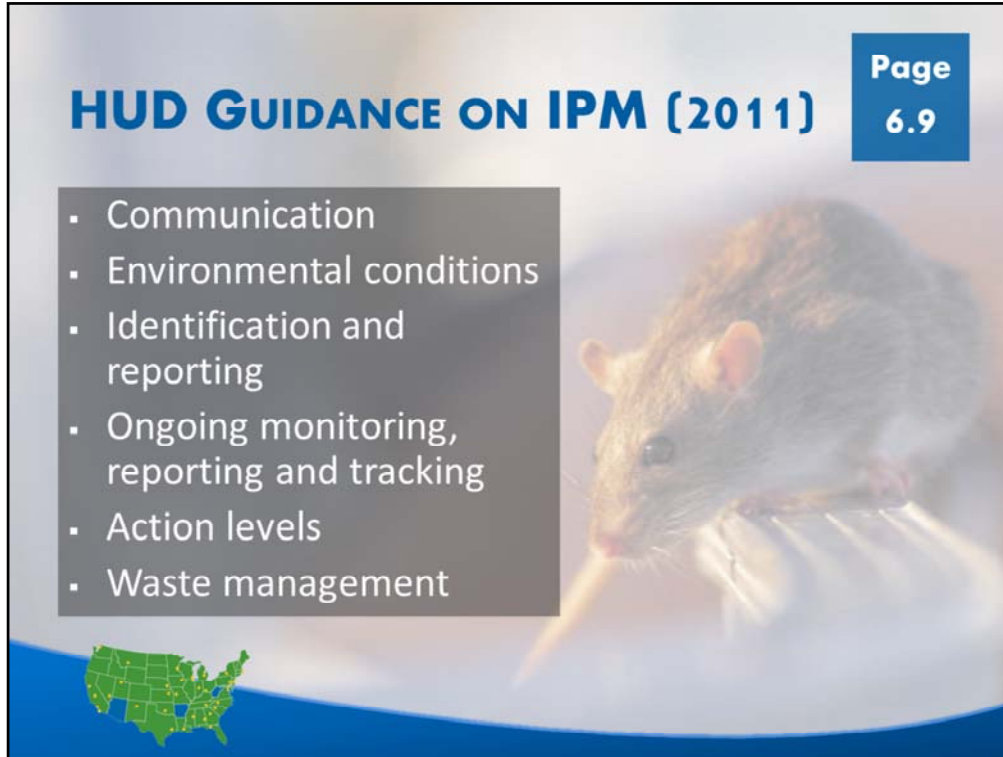
## IPM v. CONVENTIONAL PEST CONTROL

Activities	Conventional	IPM
Program Strategy	Reactive pest control	Preventive pest control
Resident Education	Minimal	Extensive
Spraying & Fogging	Extensive	Rare
Rodent/bird control	Poisons	Exclusion/ Trapping



This slide helps draw out the differences between IPM and conventional pest control.


Spraying and fogging are discouraged because of the lack of control and potential for greater exposures.

A presentation slide titled "HUD GUIDANCE ON IPM (2011)" with "Page 6.9" in the top right corner. The slide features a list of six bullet points on the left and a photograph of a mouse on the right. At the bottom left of the slide is a small green map of the United States. The background of the slide is a light blue gradient with a white mouse in the center-right.

**HUD GUIDANCE ON IPM (2011)**

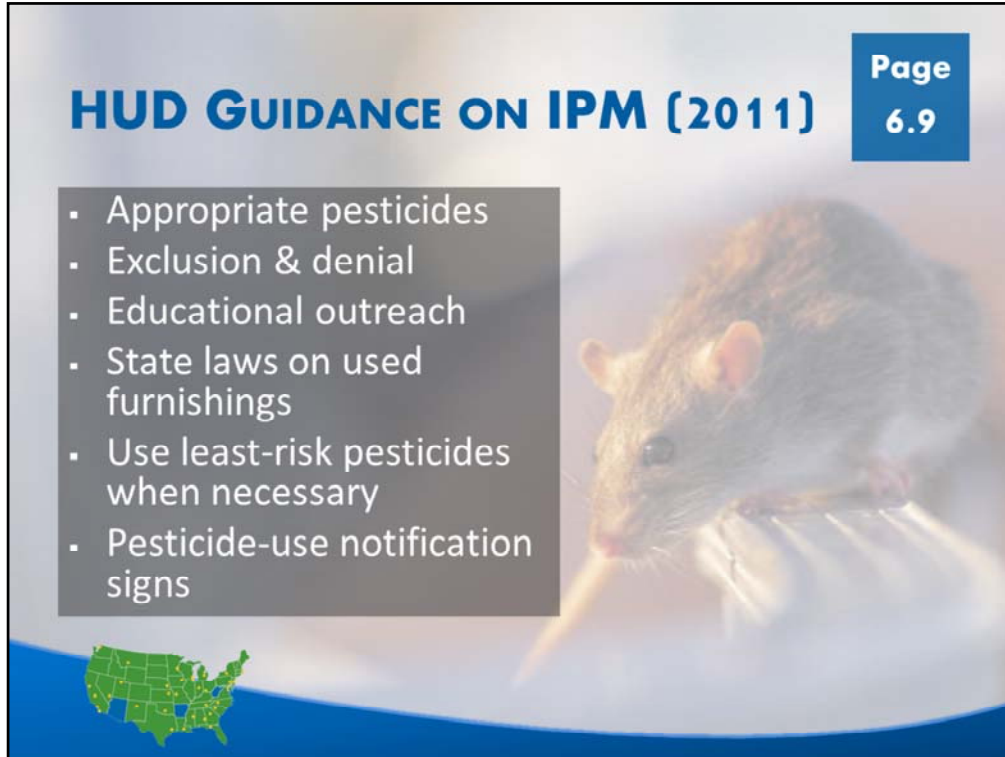
Page 6.9

- Communication
- Environmental conditions
- Identification and reporting
- Ongoing monitoring, reporting and tracking
- Action levels
- Waste management



- a. Communicate policies & procedures
- b. Identify environmental conditions conducive to pests
- c. Identify & report pests
- d. Establish ongoing monitoring, reporting and tracking systems
- e. Determine action levels
- f. Improve waste management


HUD Notice PIH-2011-11, April 26, 2011, Promotion of Integrated Pest Management (IPM)... [Download PIH2011-22](#)

A presentation slide titled "HUD GUIDANCE ON IPM (2011)" with a blue header and a blue footer. The slide features a background image of a mouse on the right and a green map of the United States on the left. A dark grey box on the left contains a bulleted list of IPM strategies. A blue box in the top right corner indicates "Page 6.9".

**HUD GUIDANCE ON IPM (2011)**

Page 6.9

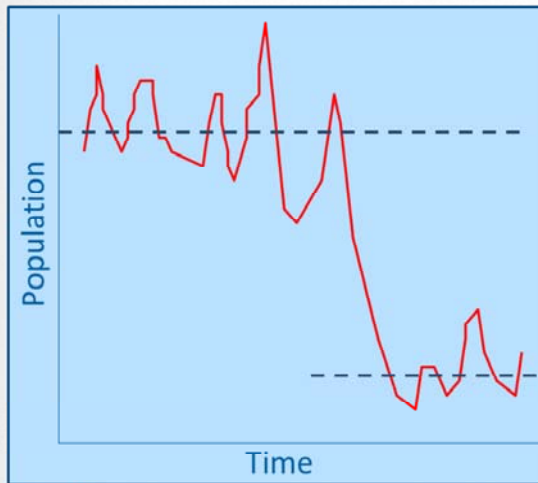
- Appropriate pesticides
- Exclusion & denial
- Educational outreach
- State laws on used furnishings
- Use least-risk pesticides when necessary
- Pesticide-use notification signs



HUD Notice PIH-2011-11, April 26, 2011, Promotion of Integrated Pest Management (IPM)... [Download PIH2011-22](#)

## CHANGE THE HABITAT

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- Don't just kill, change "conditions conducive" to pests
- Reduce the carrying capacity of the environment



Think of a building as having a carrying capacity for a given species. Carrying capacity is defined as enough food, shelter and water at the right temperatures to sustain some maximum number. Colonized for long enough the population will hover around the carrying capacity. If pesticides or trapping alone are used to decrease the population, the numbers will spring back to carrying capacity when the trapping or pesticide use stops. If, however, the entry points to the building, nest sites, food and water locations are sealed, the carrying capacity has been lowered. Removing pest food or storing human food (and food waste) in pest proof containers further lowers the carrying capacity. In a pest proofed building, pesticide use can be drastically reduced.

## IPM: STEP-BY-STEP

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- Inspection & Identification
- Exclusion & Denial
- Education & Action
- Sanitation
- Physical control
- Monitoring



## 1. INSPECTION & IDENTIFICATION

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6.10

- Thorough inspection
- Identification of pests found




### Thorough inspection

Exterior  
Interior  
Focus Areas

### Identification of pests found

Experienced field personnel  
Field guides  
Urban entomologist

Applying IPM begins with through inspection, beginning with the exterior of buildings, looking for ways that pests can enter. Under doors, through unscreened open windows, through pipe penetrations – in fact, through *any* penetration of walls, especially any hole  $\frac{1}{4}$ " in diameter or wider – the minimum size for a mouse to squeeze through!

Interior inspection is looking for the same points of entry, plus harborages (cracks and crevices behind cabinets and baseboards, inside appliances, etc.), food sources (crumbs, litter, garbage, pet food or feces...), and water sources (leak, drips – under the kitchen sink, for instance).

Focus areas are areas of concentrated pest activities. In apartments this may be stoves, refrigerators, or trash cans. In multi-unit buildings some units may be the source of infestations in other units. Trash chutes, compactor rooms, or foodservice facilities are other common focus areas. Unique issues may be identified for a particular property: every building is different, as are the occupants!

As noted, correct identification of pests is essential. Cooperative Extension services in each state will identify insects for free; many universities or pest control companies have a Board Certified Entomologist (BCE).



## SEE THE CREATURE, BE THE CREATURE

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6.11

What to look for and where to look

- The pest
- Droppings
- Nests and burrows
- Food and water sources
- Hidden places
- Near entry holes
- Warm cavities for insects



Look for signs that a building is colonized by pest species during an assessment. <sup>[5]</sup> All of them are looking for food, shelter, water and a mate. Most of them are prey species, so they are uncomfortable when out in the open. The more you are able to think like the creature, the more you are able to identify signs that they are present.

The EPA Region 9 IPM for schools manual has fairly detailed information on many common species. <sup>[6]</sup>

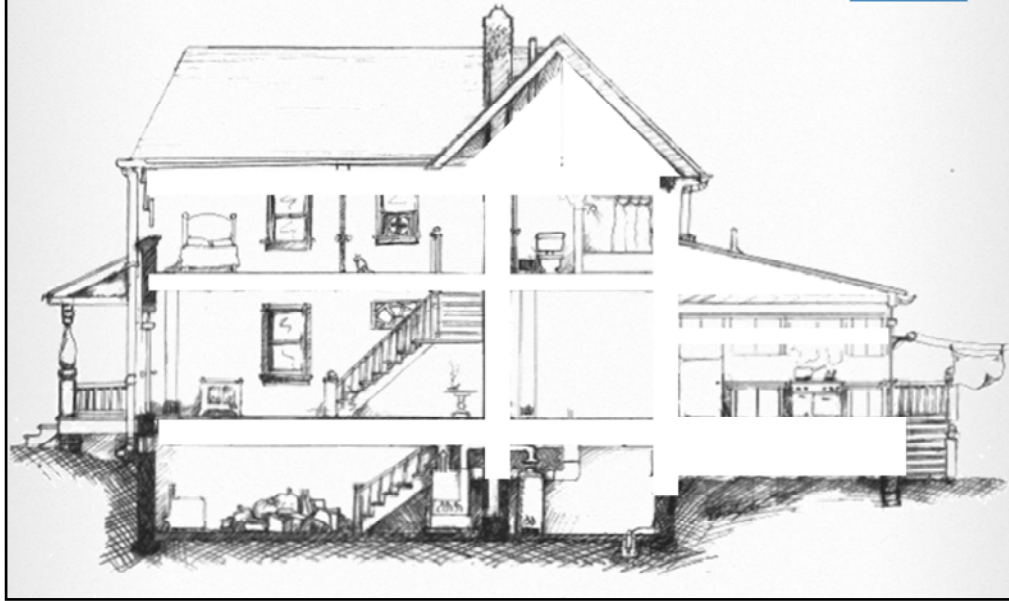
“See the creature, be the creature”

What to look for and where to look

- The creature
- Creature droppings
- Nests and burrows
- Good food – under sinks, kitchens, trash bins
- Source of water
- Hidden places – inside walls, under/behind cabinets, basements/crawlspaces/attics, waste bins, under baseboards
- Near entry holes (from exterior inspection)
- Warm cavities for insects (inside TV’s, computers, smoke alarms)

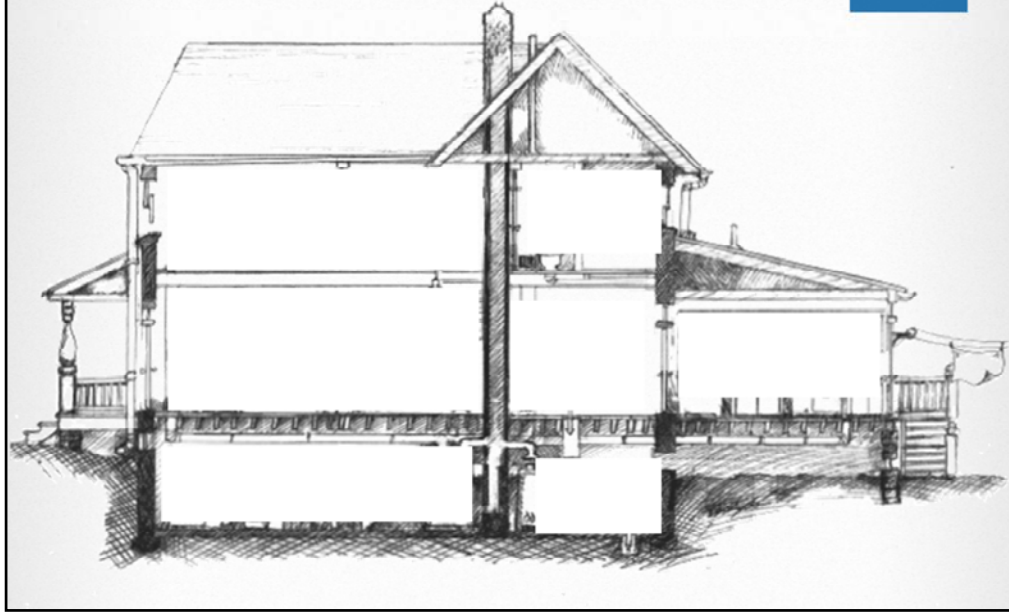
# A PERSON'S VIEW

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# A COCKROACH'S VIEW

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6.12



## A COCKROACH'S VIEW

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**Page**  
**6.13**

*Rat proofing did not work here...*

*Get down on the ground and look under the pipe...*



Rat burrow entrance

Look for evidence of burrows or nests. Notice an ineffective effort to block the original entry point. Burrowing rodents may tunnel downward for several feet.

## 2. EXCLUSION AND DENIAL

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- Stoppage
- Inspection
- Holes filled
- Stuff-It
- Silicone Caulk
- Spackle, etc





Exclusion is the stopping of the penetrations and harborages found during inspection. Door sweeps are an easy fix – without them, mice will squeeze right under doors. They do need periodic replacement, as the photo shows! All cracks and crevices should be sealed with silicone caulk (more durable than acrylic or latex, and also water-proof, heat-resistant, and gnaw-resistant). Any crevice more than  $\frac{1}{4}$ " wide will need to be packed with copper or stainless steel (rust resistant!) mesh before sealing with caulk, spackle, patching concrete, sheet metal, or other material. This helps prevent rodents from gnawing through the patch. Expanding spray foam ("Stuff-It" or other brands) can help fill larger holes, such as in basement walls or behind kitchen cabinets.

For information on designing buildings that are more resistant to common pests, see Pest Prevention by Design Guidelines ([http://www.sfenvironment.org/sites/default/files/fliers/files/final\\_ppbd\\_guidelines\\_12-5-12.pdf](http://www.sfenvironment.org/sites/default/files/fliers/files/final_ppbd_guidelines_12-5-12.pdf)) produced by the San Francisco Department of the Environment in November 2012.

### 3. EDUCATION & ACTION

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- Understand pests
- Control – what, how, and when
- Safe vs. unsafe practices
- Educating residents
- Choosing PCO's
- Training PCO's



We can build them out, but it's what *people* do that determines whether pest control is successful. Every person is part of the IPM Team. IPM is a team approach, and requires communication and education – of residents, facilities staff, and possibly of PCO's as well! Residents – especially children – can often pinpoint pest runways and nest sites. Everyone should understand what the pests are, how they are being controlled and why.

Uninformed residents may, for instance disturb or even throw out glue boards, strap traps, and other control measures, They may use inappropriate chemicals that interfere with control – for instance spray pesticides act as repellents, and will keep cockroaches from feeding on baits, such as Combat. This can be a major cause in the failure of baits and gels to eliminate cockroaches.

Residents and building staff should understand *why* IPM methods are being used, and that the safety of their family, pets and home are primary decision factors, and that more familiar methods have higher risks, as well as may interfere with IPM controls. Foggers are a good example of a very high risk product (they both coat the inside of the home with pesticides, and are explosive!) that can send people to the hospital, and can make other controls ineffective.

## 4. SANITATION

- Food
- Water
- Harborage

Page  
6.15





Clean up:  
 Food storage  
 Water  
 Harborage  
 Dishes in sink  
 Pet food  
 Trash cans

Most pests rely on **our** sloppiness to live.

How much food does a cockroach need? A mouse?? A drop of grease will feed 20 roaches. A mouse eats only 1/10<sup>th</sup> of an ounce a day. Potato chip crumbs in front of the TV? Yum!

They eat our crumbs, our pet's food, our garbage. Most require water – dishes left in the sink overnight is their paradise – *lots* of food & water! Pet food and water left down overnight (when our cats & dogs are mostly sleeping anyway!) is a constant source of high quality food. Even feces in uncleaned cat boxes can be food for critters!

Counters and floors must be clean and grease free; grease is a preferred, and superior, food source for cockroaches, mice and rats.

Trash cans are another huge food source for pests! In many cases, residents may not *have* covered kitchen trash cans ...or even trash cans at all! Outdoor garbage cans should have tight fitting lids, and ideally should be metal - rats and squirrels easily gnaw through plastic! These are essential items, and providing them to residents who lack proper trash and garbage cans should be a basic element of IPM programs



WATER

Page  
6.15

- Essential for insects & rats, but not for mice or bedbugs
- Mosquitoes
- Structural damage





Photo: City of Houston Bureau of Children's and Environmental Health



- Essential for insects & rats
  - Not for mice or bedbugs
- Mosquitoes
  - Standing water
- Structural damage
  - Gutters & roofs
  - Leaks from outside
  - Plumbing & interior leaks
    - Sink trap; plumbing entry

Again – most pest *must* have a source of water. Leaving a meat-tray in the sink – not good hygiene! (It can also expose residents to Salmonella, E.coli or other pathogens from the meat, too!)

Leaks from plumbing, and condensation, are major sources of water. Many sinks drip from the drainpipe under the sink – result of simple condensation. Warm air in the cabinet hold moisture which condenses on the cold pipe, just as water droplets form on a cold drink in summer. This drips, and can rot the plywood bottom of the cabinet, providing harborage as the plywood buckles, *and food* – the rotting cellulose & glue of the plywood. This can be fixed simply: cut a piece of pipe insulation (usually black foam, usually used to maintain hot water temperature in pipes) to fit.

Mosquitoes are, of course, dependent on standing water outdoors – eliminate sources, or, if that's not possible, use mosquito “dunks” – “pucks” or briquettes impregnated with *Bacillus thuringiensis israelensis* (BtI) – a bacteria that parasitizes mosquito and fly larvae exclusively. Non toxic to fish, or anything except insects, BtI is a very effective and low-risk control.

Water damage is the biggest threat to integrity of any structure, and leaks must be eliminated, and damage repaired. Water damage can attract pests, both for water and shelter. Check roof gutter, ground slope (grade), and other possible sources of moisture.

## 5. PHYSICAL CONTROL

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6.16

- Identify & assess problem
- Same strategy
- Different tactics – pest specific



Photo: City of Houston Bureau of Children's and Environmental Health

Identify & assess problem

Same strategy

Food, water, harborage

Different tactics – pest specific

Traps

Baits for insects (not rodents)

Dusts

Biorational chemicals: IGR's

Note the photo – roaches living in a cardboard box, protected by the plastic overwrap - **Q:** What would you do about this? **A:** Dispose of plastic & cardboard (in a sealed plastic trash bag!), vacuum up roaches, wash the baby food jars in warm soapy water to remove allergens!

After basic prevention – that is removal of conditions conducive to pests: food, water and shelter – control efforts begin. The methods – tactics – used will be specific to the pest.

Traps, ranging from glue traps for roaches to snap or “curiosity” traps for mice are a vital tool.

Cockroach control was transformed in the early '90's by the availability of baits & gels, which can be 100% effective in two weeks or so, as opposed to conventional spray pesticides which only affect cockroaches in the open – no more than 20% of any given population. Baits and gels are carried back into walls where cockroaches live, and poison all the roaches through a domino-effect: roaches eat each other's feces, and dead roaches, spreading the poison. When eggs hatch, the babies (nymphs) feed on the dead adults, and the colony crashes, usually within two weeks.

Inert dusts (that is dusts that do not contain an active pesticide, including boric acid and diatomaceous earth (DE) are also effective control for most bugs. They work by drying out (“desiccating”) the insect; DE also scratches the cuticle (skin) of the insects, accelerating desiccation. Dusts are very fine, and although inert dusts have low toxicity to mammals (ie, us!), they *are* respiratory problems, especially for people with asthma or other respiratory problems. Dusts should never be used in exposed piles, lines, cups, or on mattresses; they should instead be puffed into enclosed voids (behind cabinets, into walls, etc), where they will contact the bugs, not us.

IGR's interfere with the insects' ability to shed its skin – necessary for it to grow. They therefore cannot mature or reproduce: colony collapse occurs. The immature and affected bugs continue to grow inside their too-small skin, and are crushed by their own growth!

## REDUCE EXPOSURE

Choose safer products

Page  
6.17

- Roach baits
- Gels
- Dusts
- Glueboards and Snap Traps



Enclosed, tamper-proof roach baits  
Baits attractive if no competing food sources  
Gels applied in small dabs in cracks  
Some dusts (boric acid)  
Glueboards and Snap Traps  
Watch for signal words on cleaning products  
Choose (or make) “green” cleaners

**Page  
6.17**

## ILLEGAL AND RISKY PESTICIDES

- Pesticides that look like candy - mothballs
- “Miraculous” Chinese Insecticide chalk
- “Tres Pasitos”
- Many pesticide have been withdrawn


candy!



When conducting your assessment, you should also look for illegal pesticides in the home. Illegal pesticides are often much more toxic than registered pesticides (those that EPA has approved).

**Illegal naphthalene moth repellent products** – Mothballs pose a hazard to young children. Mothballs can be easily mistaken for candy, or simply tempt young children to touch and play with them. Recent studies have linked naphthalene to illnesses, including nasal cancer. Widespread sale and distribution of these products make illegal mothballs a particular concern.

**Illegal Insecticide Chalk** is also known as "Miraculous Chalk" or "Chinese Chalk." You may have seen the chalk in a neighborhood store or sold on the street for about \$1 a box. It is mostly imported illegally from China and often bears a label in both English and Chinese. Sometimes the manufacturer claims that the chalk is "harmless to human beings and animals" and "safe to use." These claims are untrue and dangerous.


**"Tres Pasitos"** is imported illegally from Mexico and other Latin American countries. Its name means "three little steps" in English, because after eating it, this is all mice can muster before dying. The active ingredient (or the chemical that actually kills the pest) in "Tres Pasitos" is a chemical called aldicarb. EPA considers aldicarb to be a very toxic chemical - and one that should never be used in your home. Children are especially vulnerable to poisoning by aldicarb when it is sprinkled around the home to control roaches, mice and rats. Exposure to high amounts of aldicarb can cause weakness, blurred vision, headache, nausea, tearing, sweating, and tremors in people. Very high doses can kill people, because it can paralyze the respiratory system. What "Tres Pasitos" does to pests, it can also do to you.

Recommend disposal of pesticides and use of integrated pest management as a “safer” alternative.

## FEDERAL PESTICIDE LAW

**Page  
6.18**

- Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA)
  
- Administered by EPA
- Pesticide – Broad term
- No pesticides are safe – some are low-risk
- The label is the law



Administered by EPA

Pesticide – Broad term includes anything that kills or repels:

Insects

-- Fungus

Plants

-- Mold

Rodents

-- Microbes

No pesticides are safe – some are low-risk

The label is the law!

**ARE THESE LABELS?**

Page  
6.19



The image shows two product labels side-by-side. The left label is for 'Rat Killer Place Packs' and features the text 'Rat Killer' in large white letters on a black background, 'Place Packs' in a white box below it, and 'Kills Rats & Mice' in yellow text on a dark blue background at the bottom. The right label is for 'FOGGER' and has a green background with 'FOGGER' in large white letters at the top. Below it, it says 'KILLS FAST! KEEPS ON KILLING' in yellow. In the center, there is a circular graphic with a blue insect and the text 'KILLS HIDDEN BUGS!' in yellow. At the bottom, it says 'Now with ODOR NEUTRALIZER' in white and yellow text. A small green map of the United States is visible in the bottom left corner of the slide.

No, they provide information about the product but they are not the labels that EPA reviews and approves. Labels should have a signal word such as Caution, Warning, Danger, Poison (usually with skull and crossbones).

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6.19**

## EPA PESTICIDE PRODUCT LABELS

- Product Name
- EPA Reg. No.
- Ingredients
  - ◆ Active
  - ◆ Inert / Other
- “Keep Out of Reach of Children”
- First Aid
- Net contents



**Signal Word:**  
 Caution  
 Warning  
 Danger  
 Poison – skull & crossbones



EPA approves the language and layout for the label on every pesticide. Copies of all labels are available online at [www.epa.gov/pesticides/pestlabels/](http://www.epa.gov/pesticides/pestlabels/). For labeling requirements, see [www.epa.gov/oppead1/labeling/lrm/](http://www.epa.gov/oppead1/labeling/lrm/).

EPA requires that the front panel include the information identified above. Back panel typically includes:

- EPA Registration Number - identifies the manufacturer/formulator and the product.
- Company Name and Address
- Precautionary Statements
  - Hazards to Humans and Domestic Animals
  - First Aid
  - Environmental Hazards
  - Physical or Chemical Hazards
- Directions for Use
- Storage and Disposal
- Warranty Statement (voluntary)
- Worker Protection Labeling

The product name was excluded to avoid appearing to endorse a particular product.

**Page**  
**6.21**

## 6. MONITORING

- Keep looking for pests
- Spot reinfestations
- Place in corners
  - ◆ Behind appliances
  - ◆ Under sink
  - ◆ Under cover!
- Do date & mark
- Don't disturb





Monitors are glue traps that are used to check for pests, to identify pests, and to identify the extent of an infestation. The bottom photo show an example: German cockroaches, in a large breeding population, with a nest near where the bottom edge of the monitor was placed

Insect monitors come in many styles; most fold up into a covered shape to protect the sticky trap from dust. Monitors should always be dated, and have the trap location marked. Place against walls, in corners, behind & under cabinets, appliances, etc. Use 3-6 per kitchen, and at least one in each other room, including bedrooms. Check within 48 hr during initial clean-out operations; replace as needed. When population is controlled, check monthly to be sure reinfestations isn't happening. If new pests are observed on the monitors, begin control again, but do not apply controls unless the monitors show the need!

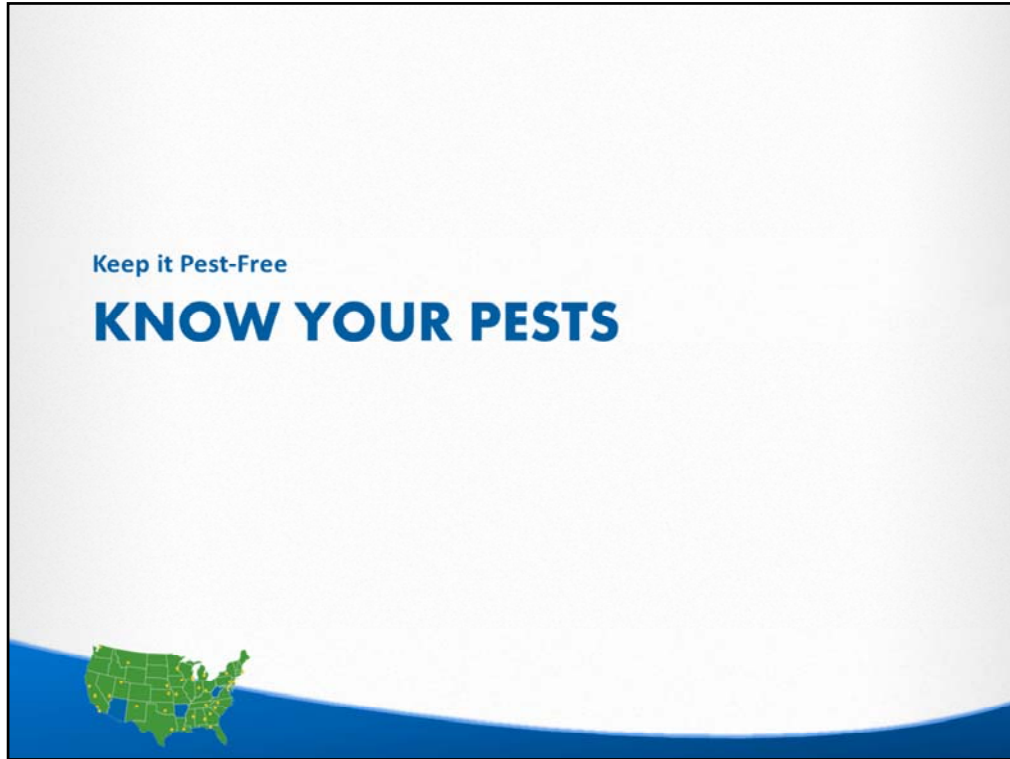


## MONITORING FOR RODENTS

Page  
6.21

- **Similar to insects – use snap traps or glue-boards**
- Place in corners, along runways, in tight dark spaces
- Check daily
- Increase trapping if monitors indicate activity
- Always have monitors for insects and rodents in place

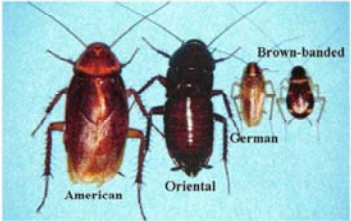





## COCKROACHES

- Identification & biology
- Life cycle:
- Diseases
- Key harborage sites


**Page**  
**6.22**



Pest cockroaches of North America



German cockroach life cycle



### Identification & biology – 4 species

American – “waterbug”

Oriental – “waterbug”

German - common

Brown-banded - offices

### Life cycle:

Eggs

Nymphs

### Diseases

Asthma

Salmonella, etc.

### Key harborage sites??

It is essential that you be able to identify the four common species of cockroaches, and understand their basic life cycle.

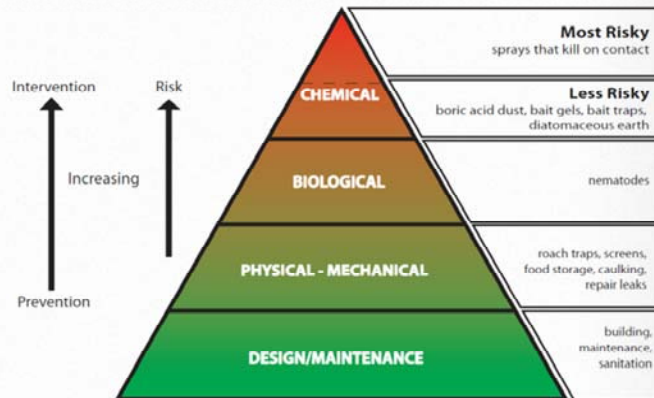
The first roach from the left is an American cockroach. About 1-1/2” long, this roach has wings and files. Often called a “waterbug,” or, in the South a “palmetto bug”, they usually live in sewers and drains, and appear in basements, kitchens and other places where there are drains and it is warm and damp.

The black roach is an Oriental cockroach – also often (and confusingly) called a “waterbug.” They live primarily *in* the ground, and prefer *cool* and damp – they surface mostly in crawl spaces and basements, and sometimes in potted plants, especially those brought indoors for winter.

On the far right is the Brown-banded cockroach. She prefers high and dry habitats, often found in common areas, offices, and other areas where carbohydrates are available (usually merely crumbs, or sugar syrup – from sodas, for instance!)

The German cockroach (third from left, top picture, and family portrait in the bottom picture) is the basic kitchen cockroach: brown, 3/4” long, with “racing stripes” down her back. On the left is the adult male. The larger female carries her egg case almost until it hatches (it’s protruding from her abdomen), at which point she drops it (brown, curved object below). Within 48 hours it hatches: up to 40 babies – nymphs - emerge, and go through 5 molts in a month or so depending on food, warmth and other conditions, until adulthood. Adults

have wings (but don't fly); nymphs don't. German roaches are the most prolific roach, and eat almost anything, although grease is their favorite food



**Pyramid of IPM Tactics for Roaches**



The basis of effective cockroach control is at the base of the pyramid: making the structure roach-proof, and ensuring sanitation to deny the roaches food. The second stage is eliminating sources of moisture, and keeping up with new repairs, proper food storage, and other standard procedures – but no “deferred maintenance”.

There are not good biological controls for cockroaches indoors – except in the semi-tropics, where lizards are fond of them. While the pyramid lists nematodes – introducing microscopic parasitic worms into buildings has not been popular in practice.

Biorational controls for cockroaches include the use of inert dusts in enclosed spaces (usually within walls where the insects nest), baits, gels, and insect growth regulators. Conventional kill-on contact sprays, aerosols and foggers in the tip of the pyramid are seldom used in IPM, except for “emergency” applications. An aerosol might be appropriate to eliminate a stinging insect nest over a school door. A liquid spray crevasse application might be used in a boiler room to eliminate a population before the crevasse is sealed. All pesticide applications must be done only by licensed pest control applicators.





Frass along the top of a door, under a shelf, and on a wall where a clock was hung (*note that when the clock was there the place looked clean...trainees have to know where to look to find signs*).

*Suggestion: use the clock as a review of the kinds of cockroaches. The kind that infested behind the clock were Brown Banded (high and dry).*

## COCKROACH CONTROL

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6.25

- Habitat modification
- Monitors
- Dust and caulk
- Baits and gels
- Insect growth regulators
- Sticky traps



Cockroach control involves removing their food, their water, and their hiding places, as already discussed.



In addition to the dusts (boric acid and DE), caulk, glue boards, baits, gels and IGR's already mentioned, vacuum cleaners are an excellent tool for removing large infestations immediately.

A HEPA (High Efficiency Particulate Air filter) vacuum *must* be used to prevent the potent cockroach allergen from being blown out of the vacuum and widely dispersed into the living space! A vacuum can suck up thousands of roaches; but - be sure to remove, double bag, and dispose it *immediately* to prevent infestation of the vacuum!

## RODENT CONTROL

Page  
6.26

- Rodents are mammals like us
- Think like a rodent
- Not all rodents are the same
  - ◆ Mice – curious & persistent
  - ◆ Rats – cautious & smart
  - ◆ Squirrels - outdoors



Rodents are “commensal” – that is they “feed at our table.” They are mammals, like us, and need the same conditions we do, and will eat anything we can. Rats need water; mice get their water from their food, and don’t need, but will drink, free water.

Rats and mice have another difference – apart from size! – mice are curious, while rats are cautious, almost to paranoia.

Squirrels are difficult to remove from buildings. However they are rodents, and are attracted to rodent baits: if rodenticides are not properly secured, squirrels are a frequent non-target kill. This can be a public relations problem, particularly in parks or other public areas.



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**6.26**

## RODENT IDENTIFICATION

- House Mouse
- Also: White Footed, Deer
- Norway Rat
- Brown rat, Wharf, Sewer, etc
- Roof Rat
- Black rat
- Also: Cane rat, etc.
- Squirrel
- Groundhogs, etc.

large                      large

FEET                      HEAD

small                      small

**Young Rat**

Mouse feces 1/4"  
Rat feces 3/4"

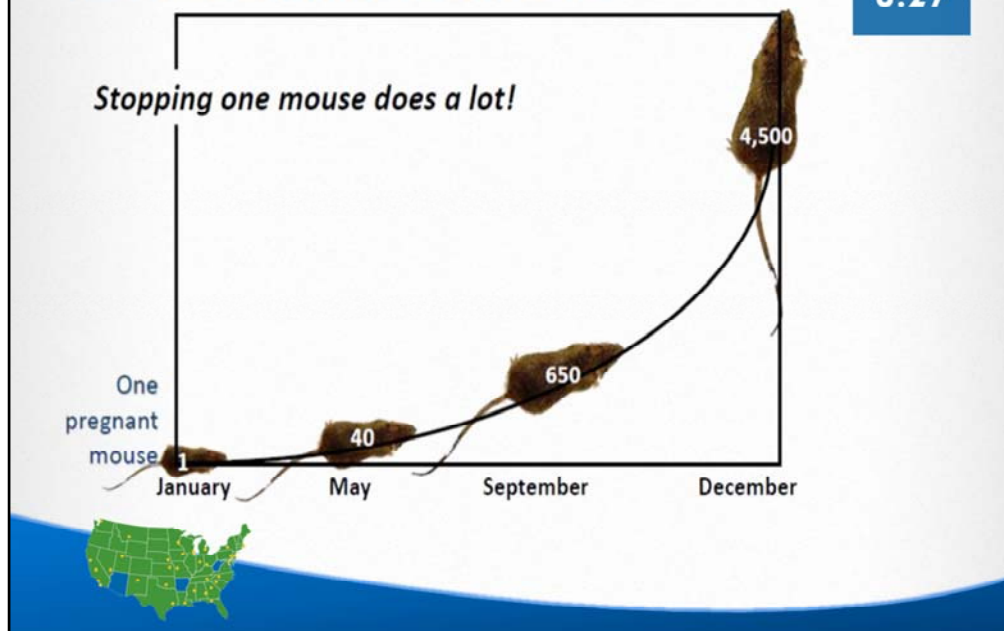
**House Mouse**

The droppings (feces) of mice differ from those of rats. Knowing the difference can help determine if the pest in question is a mouse or rat. Control of each will differ. *Droppings can help trainees find nests or burrows because they are left in areas of high activity. Rodents communicate by smelling chemicals in droppings.*

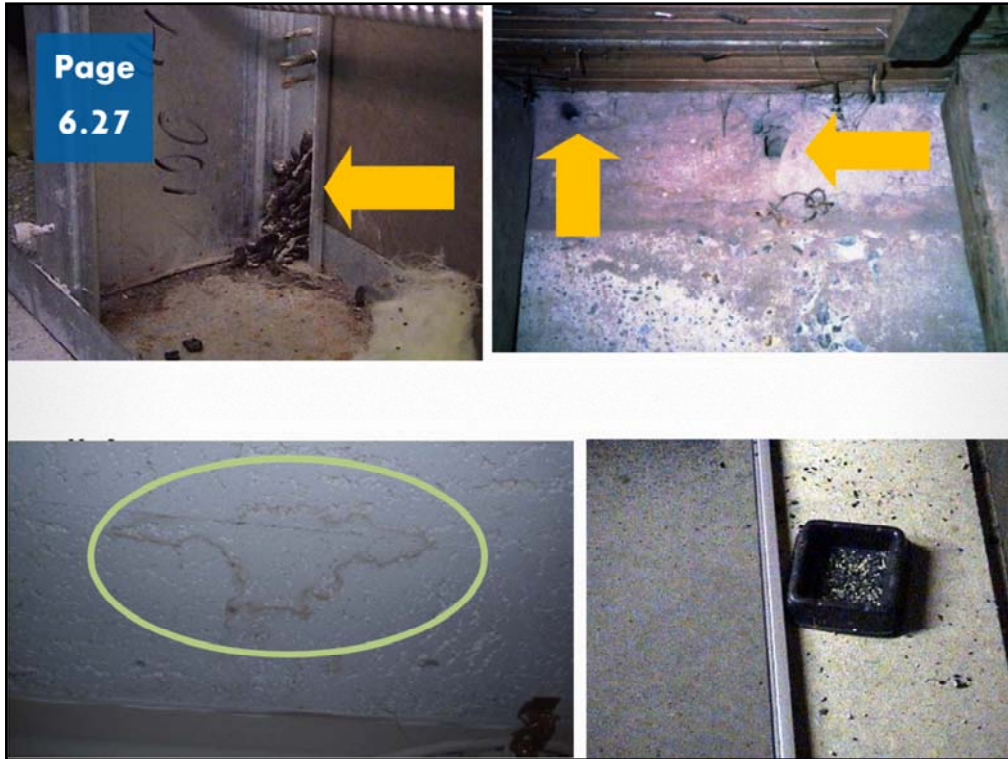
Adults can be distinguished by size, but it can be difficult to tell an adult mouse from a baby rat. The feet and head of mice seem in proportion to their bodies and their tails are thin and long, while the rats have hind feet and heads that seem larger than they should be and thick tails that are shorter than their bodies. *Mice are not small rats and mice do not become rats when they go outdoors.*

## RODENT REPRODUCTION

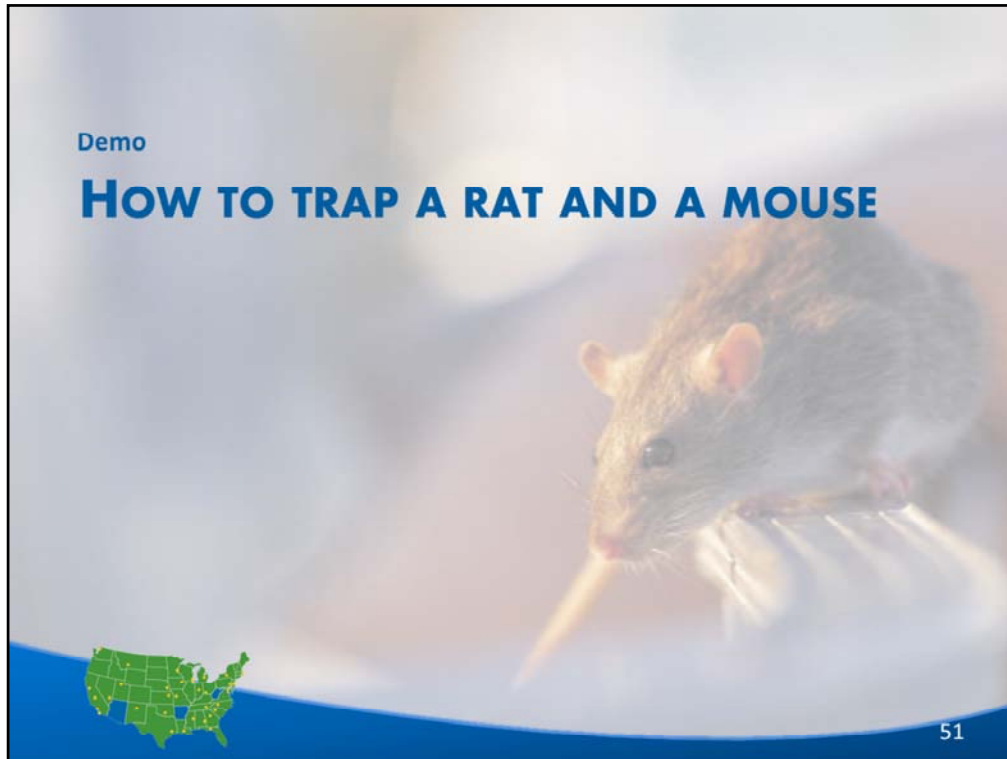
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Mice mate at 1 month of age, gestation is 19 days, 4 - 7 young per litter, 8 litters per year, 30 - 35 young weaned per female per year. This is the same as cockroaches. This graph assumes 6 litters of 6 per year. Gestation takes 1 month, reach reproductive maturity at 1 month. There are 50% females in each litter.




Top left shows rat droppings in a wall cavity. This causes an odor for years. Top right illustrates rat burrows in a clay wall in a basement. The bottom left picture is a stained ceiling tile below a mouse nest. Bottom right is an open, unsecured poison bait for rodents (note mouse droppings nearby). This picture illustrates that there is evidence that there is a pest problem.




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6.28**

## THINGS THAT DON'T WORK

- Contact sprays
- Foggers
- Mothballs
- Ultrasonic's
- Dryer sheets, etc.



Conventional sprays & aerosols must contact the insects to kill them. They do not penetrate into the walls where cockroaches live and where about 80% of the population are hiding. The sprays are also ineffective against the eggs. Therefore, the population recovers quickly.

Foggers have the same limitations, and *do not* penetrate deeply into wall structures, in spite of some marketing claims. They also distribute their toxic contents over all the surfaces in the home. While most users know to wash their dishes and pots and pans, they do not think about other surfaces. For example, couches become covered with pesticide, and when people sit on the couch absorb it into the skin. Think about all the surfaces that residents touch: light switches, door knobs, cabinet doors...and what about the floor, where the “fog” eventually settles. Are pets and children exposed because of this?



Ultrasonic devices have no effect on insects. While they do affect rodents in a laboratory, they are not effective in most residences. The signals are too directional, and do not provide wide area coverage, and mice quickly become used to them.

Finally, dryer sheets and other “internet” remedies are not proven, and may in fact result in exposure to chemicals with unknown health effects. These products are not intended for pest control, and may be neither safe or effective.

## THINGS THAT MAY WORK, BUT...

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- Essential oils and cleaners
- Carbon dioxide traps
- Kerosene
- Homemade traps and gadgets
- What have you seen?



Similarly, essential oils are also not studied for effectiveness or safety. They are, indeed, potent, may kill insects on contact, but they may have unexpected effects, including triggering allergic or asthma reactions in sensitive people. Many essential oils contain solvents, and may contain other unknown ingredients. While they may be safe in contained uses, the health effects of exposure to essential oils used for pest control are unknown. Anecdotal reports have included the damage to property and finishes, as well as triggering choking and wheezing.

Carbon dioxide traps *can* be effective monitors for bed bugs – but only in unoccupied rooms! Bed bugs are able to distinguish between a live person and a trap, and avoid the traps. They can, however, be very useful for determining that no bed bugs are present in unoccupied space, such as vacant apartments. The trap shown *did* catch bedbugs, but there commercial traps available as well.

Kerosene will indeed kill bed bugs, and many other insects, and animals: it is both a solvent (that can dissolve the insects cuticle) and a poison hazardous to most animals, including mammals, which includes us! It is also highly flammable, and is a known carcinogen. Kerosene should never be used indoors, and probably not outdoors, either!

**BED BUGS - DON'T PANIC**

Page  
6.30

- Can be avoided and eliminated
- Every skin irritation or bite is not bed bugs
- You can see them.
- Do not cause or spread diseases.
- Heat and/or steam can kill them.
- Protocols and communication key to control

The slide features a close-up photograph of a bed bug on a light-colored surface and a small map of the United States in the bottom left corner.

Bed bugs *can* be avoided and eliminated  
 Every skin irritation or bite does is not bed bugs!  
 You *can* see them.  
 They do *not* cause or spread diseases.  
 Simple **heat** and/or **steam** can kill them.  
 Protocols and communication key to control

Bed bugs are on the rise, but can be controlled – and you can avoid getting them.  
 Also – *not* every skin boo-boo is a bite, and not even every bite is from a bed bug!  
 They are not invisible – you can see them.

They do not carry or spread disease – but they are a nuisance, and can drive people literally buggy.

Although control can be challenging, as we'll see, simple heat will kill bed bugs and their eggs.

From an agency perspective, Protocols, Cooperation and Coordination are the most important factors to prevent movement of bed bugs in multi-family housing, and between residents in shelters, foster care, homes and group living.

## BEDBUGS

- Identify properly – don't assume
- Life cycle

Page  
6.30





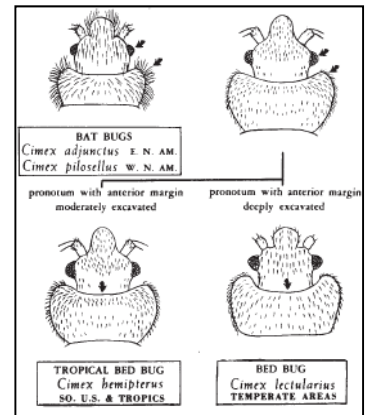
Photo credit:  
Changlu Wang & John Obermeyer/Rutgers University



- Identify properly – don't assume!
  - Bat bugs & swallow bugs
  - Cockroaches, ticks & lice, oh my!
- Life cycle
  - Nymph to adult – must feed
  - Poppy to apple-seed size
  - 6-12 eggs laid at 2-3 days
  - Eggs resistant

While bed bugs are spreading rapidly, they are NOT every where and even in beds not every bug will be a bed bug. Careful identification is important to be sure that you actually treating the correct pest, and to make sure that it won't come back. Closely related species that infest bats and birds may bite humans, and will require treatment of the primary host – bats or birds. Pubic lice – crabs – have also been assumed to bed bugs – just because a bug is in your bed does not make it a bed bug!

Bed bugs lay 6-12 eggs at a time, every two to three days, gluing them into cracks and holes. About ten days later each group hatches, meaning that new sub-colonies are constantly appearing in different places, and new eggs are being laid constantly. This makes control difficult, especially since the eggs are resistant to the chemical pesticides: even direct contact with most of the pesticides will not "kill" the egg. Heat, on the other hand, kills all stages of bed bugs, including eggs.








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6.32

## BEDBUGS - CONTROL

- Exclusion
- Preparation
- Traps – interceptors



## Exclusion

Clutter elimination - bins

## Preparation

Wash bedding

Seal mattress – encasements

NO pesticide on mattresses!

## Traps – interceptors

Make the bed an island!

Monitor

Prevention

Getting rid of the bugs means getting rid of the places they hide – and this is where clutter is important. Sanitation is not an issue with bed bugs, per se, because they only feed on us, not our garbage. But clutter provides harborage; de-cluttering is a first step.

PCO's will provide instruction for unit preparation; some residents may require assistance. Washing and dry bedding and other items on hot water settings. Use dissolvable laundry bags, or dispose of "dirty" bags and use new bags or plastic bins to return clothes to home. Don't turn a Laundromat into a bed bug transfer station!


Mattresses should be encased, *not discarded or pesticide treated!* Discarded mattresses simply pass their bugs along to someone else when the mattress is picked up of the street. While a very few pesticide labels may allow application to mattresses, the PA IPM Program does not recommend this, eve, especially on children's mattresses. The possible long term effect of sleeping on a pesticide-treated sponge has never been studied: do you want to be the test subject? **Instead: use an encasement designed to stop bed bugs!** Encasements are designed to prevent bedbugs from biting from, or getting out of the mattress, and prevent bed bugs from being able to live on the mattress. Use *only* encasements rated for bedbugs. While BB encasements will also contain dust mites and their allergens, allergen-only encasements will *not* stop bed bugs!


Simple interceptor traps, placed under the legs, can isolate the bed and make it a "safe island" within a still active treatment zone. (Mattress encasement must be used, and the bed must not touch the walls or any other object; bedclothes must not touch the floor!). Encasements and interceptors are also excellent prevention – they allow you to monitor for insects, and see and eliminate them before an infestation can be established.

## BED BUG - TREATMENT

- Inspection
- Vacuum
- Heat or cold
- Pesticides by PCO only
- Re-inspection & retreatment
- Encasements & interceptors

**Page  
6.33**





Inspection  
 Crack & crevice:  
 Treatment  
 Vacuum  
 Heat or cold  
 Pesticides by PCO *only*  
 Dusts  
 Crack & crevice treatment  
 Re-inspection & retreatment  
 Encasements & interceptors

**Inspection** is the key to bed bug treatment and control. Bedbugs hide! Finding them is a challenge. They prefer cracks & crevices as thin as a credit card; their eggs are only 1 millimeter – 1/28<sup>th</sup> of an inch!- long. Inspection means examining and disassembling, as necessary, the bed & associated systems, bedside furniture, baseboards and carpets, and possibly closets, clothes, etc. Remember that beds are not the only place people sleep – recliners, couches, wheel chairs, and all upholstered furniture will need checking. Inspection – *and only inspection* - guides treatment!

Vacuuming is very useful for removing lots of bugs quickly. Because the eggs are glued into remote and tiny locations, vacuuming is unlikely to remove all the eggs, and is not effective for total control, but it is very useful.

Heat – or cold – treatments are the current “gold standard.” Temperatures below freezing (32 ° F) or over 120°F, for more than 20minutes will kill bedbugs and their eggs. Remember to consider insulation, and how much time you may need – but anything you can put in a hot dryer for 30 min. will be fine. Steamers are also effective, but need to be professional-grade, low pressure and low vapor; application rate is 4 feet a minute – or 1 foot every 15 seconds! BB treatment takes time, and labor; that’s why it’s expensive.

Pesticides, if necessary should be applied only by a licensed pest management professional; aerosols & foggers should **never** be used.

Most control requires at least 2, usually 3 treatments 2-3 weeks apart: reinspection needs to be part of every treatment plan. Follow through on decluttering, laundering, and other PMP recommendations is essential.


While reinfestation is possible at any time, encasements and interceptors are important prevention and monitoring tools and should be left in place.


## CODE REQUIREMENTS

### Code requirements related to pests

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- Extermination
- Infestation
  - 308.1 Infestation
- 302.5 Rodent harborage
- 304.14 Insect screens
- 308.2 Owner
- 308.3 Single occupant
- 308.4 Multiple occupancy
- 308.5 Occupant.





**EXTERMINATION.** The control and elimination of insects, rats or other pests by eliminating their harborage places; by removing or making inaccessible materials that serve as their food; by poison spraying, fumigating, trapping or by any other approved pest elimination methods.

**INFESTATION.** The presence, within or contiguous to, a structure or premises of insects, rats, vermin or other pests.

**308.1 Infestation**

Structures kept free from insect /rodent infestation  
Promptly exterminated by approved processes (not injurious to human health)  
After extermination, proper precautions taken to prevent reinfestation

**302.5 Rodent harborage.**

All structures and exterior property kept free from rodent harborage and infestation  
Promptly exterminated by approved processes (not be injurious to human health)  
After extermination, proper precautions taken to eliminate rodent harborage and prevent reinfestation

**304.14 Insect screens.**

During the period from [DATE] to [DATE]  
Tightly fitting screens on:  
every door, window and other outside opening required for ventilation of habitable rooms  
food preparation areas, food service areas or any areas where products to be included or utilized in food for human consumption  
are processed, manufactured, packaged or stored  
Not less than 16 mesh per inch  
(16 mesh per 25 mm)

**308.2 Owner.** The owner of any structure shall be responsible for extermination within the structure prior to renting or leasing the structure.

**308.3 Single occupant.** The occupant of a one-family dwelling or of a single-tenant nonresidential structure shall be responsible for extermination on the premises.

**308.4 Multiple occupancy.** The owner of a structure containing two or more dwelling units, a multiple occupancy, a rooming house or a nonresidential structure shall be responsible for extermination in the public or shared areas of the structure and exterior property. If infestation is caused by failure of an occupant to prevent such infestation in the area occupied, the occupant shall be responsible for extermination.

**308.5 Occupant.** The occupant of any structure shall be responsible for the continued rodent and pest-free condition of the structure.

**Exception:** Where the infestations are caused by defects in the structure, the owner shall be responsible for extermination.

## RESOURCES

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- Cooperative Extension Services
- State Pesticide Regulator for Pest Control Applicators/Operators
  - ◆ Often at universities
- [www.ehw.org](http://www.ehw.org)
- [www.nchh.org/Training/IntegratedPestManagementIPM.aspx](http://www.nchh.org/Training/IntegratedPestManagementIPM.aspx)



Go to [www.csrees.usda.gov/Extension/](http://www.csrees.usda.gov/Extension/) to find your local cooperative extension system office.

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## KEY MESSAGES

- Pests can create allergens and be vectors of disease.
- Control of pests through pesticides can lead to poisonings and other neurological problems.
- Some pesticides found in homes have been banned.
- Make house less hospitable for pests. Prevent entry, control food, water, and places for shelter.
- Integrated Pest Management is the recommended strategy.



## LEARNING OBJECTIVES

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Name three illnesses or injuries associated with pest infestation.

Identify three clues of pest infestation.

Identify the three strategies associated with an IPM approach.

Name two illegal pesticides that may be used in the home.

