



PESTICIDE MISUSE AND THE NATIONAL BED BUG EPIDEMIC — AN EMERGING PUBLIC HEALTH ISSUE

Michelle Colledge, ATSDR Amy Mysz, U.S. EPA





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OVERVIEW De Marine Mari

- Introduction
- Bed Bugs
- Review of incidents in R5 and nationally
- Case Study
- Projects to evaluate national misuse trends
- Open Discussion

HOW WE GOT INVOLVED

 On June 14, 2010 ATSDR R5 was contacted by an EPA on-scene coordinator asking for technical public health assistance





There was a reported indoor application of Spectracide Malathion Spray Concentrate at several residences June 2nd-4th, 2010 in Cincinnati OH

HOW WE GOT INVOLVED (CONT)

 A resident contacted the Rocky Mountain poison control center because his family was experiencing acute health effects





- USEPA requested that ATSDR R5 provide the following guidance:
 - review limited sampling and exposure data
 - make recommendations for additional sampling
 - make recommendations for health-protective cleanup strategies
 - provide "safe" reoccupation limits

HOW WE GOT INVOLVED (CONT)

 We discovered the Ohio misuse case was just one of many in this region and across the country

 A review of national databases indicate that pesticide misuse for bed bugs and other pests is an emerging public health issue





BED BUG IDENTIFICATION AND LIFECYCLE

- Six legs
- Flattened, oval bodies
- Adults are brown to red in color (size of apple seed)
- Eggs are white 1-2 mm
- 5 growth stages, requiring a blood meal for each stage
- Crawl, do not jump or fly
- No nesting site, but tend to congregate
- Usually active at night (1-3 AM)
- Only feed on blood and prefer people
- May travel far (10-20 ft) and fast



Photo Courtesy of Stephen Doggett, Department of Medical Entomology, Westmead Hospital, Sydney, Australia (from epa.gov/pesticides/bedbugs)

BED BUG IMAGES



Photo from presentation slides of L. Garling, PA St Univ and D. Gouge, Univ AZ via D. Baumgartner, EPA R5

CAN YOU IDENTIFY THE BED BUG?







- Rapid proliferation: female lays 250-500 eggs, Eggs hatch in 7-10 days, mature in 1-2+ months
- May live extended periods without feeding
- Occur ANYWHERE: clean or dirty, good hitchhikers and hiders, elusive
- Difficult to control: Pesticide resistance is common; few effective products, especially for eggs; difficult to get at all hiding places
 - Lack of information



Source: L. Garling, PA St Univ via D. Baumgartner, USEPA

BED BUGS IN NEW YORK CITY

Number of Complaints to NYC Dept of Housing Preservation and Development



Source: New York City Department of Public Health and Mental Hygiene

BED BUG COMPLAINTS BY YEAR IN OHIO



Franklin County (Columbus), Ohio

Source: M. Beal ODA

BED BUG MANAGEMENT INTEGRATED APPROACH

- Thorough Inspection/Monitoring
- Clutter Removal/Cleaning
- Mattress Encasements
- Isolation
- Laundering/Hot Drying
- Vacuuming (HEPA)
- Steam
- Hot/Cold Treatments
- Pesticides







ONLINE RECOMMENDATIONS FOR BED BUG CONTROL

Posted in response to The Huffington Post article "U.S. Grappling with Bedbugs, Misusing Dangerous Pesticides" 8/30/10 (http://www.huffingtonpost.com/2010/08/30/us-bedbugs-epidemic-outdoor pesticides n 699745.html)

Shakes The Clown 8/31/2010 "Go out and get some Malathion at the hardware store. Just take care in the application process, wear goggles and a dust mask, long sleeves and sweat pants. Don't get it on your skin while it is wet, that is when it is toxic. The stuff works.

Malathion will kill all of your bed bugs. It is banned from indoor use inside the US, but you can still buy it for outdoor use. It is recommended by the World Health Organization. Screw the EPA. Don't pay an exterminator hundreds or thousands when they can't even use something as powerful as you can buy at Lowes or Home Depot. Malathion is the whip. http://cesspoolofhumanity.blogspot.com/2010/08/malathion-will-kill-

your-bed-bugs.html"

OTHER CREATIVE PRACTICES





- Gasoline (or kerosene) on mattresses, baseboards, wallpaper and body parts
- Cedar oil, tea tree oil, other "natural" products
- Bleach, ammonia
- Applying pesticides to skin
- Flea collars in luggage



Burn candlestick wax onto bugs and eggs



MISUSE CASES BROUGHT TO REGION 5'S ATTENTION

- 23 cases in 13 states between 2009-2011 OH, IN, MN, WI, MI, IA, TN, KS, GA, NC, CT, NJ, MA
- Some involved hundreds of properties:
 up to 154 locations in GA
 - nearly 500 locations in 2 NJ cases
 - unknown # of homes and apartments in 2 MA cases
- Occurred in apartments/multi-unit dwellings, single family homes, hotels, restaurants, nursing homes/healthcare facilities



MISUSE CASE SUMMARY (CONT)

Target Pests: about ½ bed bug related others for ants, termites, fleas, etc.



- Pesticides applied mostly by occupants and unlicensed applicators, but some by licensed applicators
- Pesticides applied to high contact surfaces and even body parts
- Some applications excessive-dripping down walls, soaking furniture, or leaving puddles and visible dust covering walls and surfaces

TYPES OF APPLICATIONS AND PRODUCTS

- Outdoor Pesticides Applied Indoors (16)
 carbaryl (dust & liquid), malathion, diazinon, fipronil
- Over/Mis-Application of Approved Pesticides (8)
 fipronil, zinc phosphide powder, various pyrethroids, chlorfenapyr, imidacloprid; intensive use of bug bombs; use of multiple products, repeat applications
- Banned or Unregistered Pesticides (2) mixture of carbaryl, cyfluthrin, bleach and turpentine, or illegal imports



MISUSE IMPACTS

- Specific health complaints in ten cases:
 - <u>Neurological</u>: headache, nausea, dizziness, fatigue, tingling lips, tremors, seizures
 - <u>Gastrointestinal</u>: diarrhea, vomiting
 - <u>Respiratory</u>: difficulty breathing, nosebleeds
 - <u>Cardiopulmonary</u>: chest pain or tightness
 - Ocular: eye irritation, blurry vision
 - Death: 1 fatality



- "Elevated" pesticide residues found on indoor surfaces
- Premises vacated in nearly 1/2 the cases

REMEDIATION

Recommended/requested in 17 cases



- No cleanup or uncertain results for some
- Initial remediation efforts were unsuccessful
- Additional cleaning and remediation were necessary
- Involved multiple agencies/lots of resources:
 - state and local health departments
 - fire and police departments
 - property owners/housing authorities
 - state pesticide regulatory agencies
 - ATSDR, U.S. EPA

BASIC QUESTIONS



✓ Is it Safe? / What level is safe?

Does it need to be cleaned up?

✓ How do I clean it up?





CHALLENGES

 No health-based indoor screening or surface residue values



- Difficult to interpret typical samples collected (e.g. surface wipes, physical samples (carpet, clothing..)
- No cleanup procedures established and issues with the few that exist
- Lack of indoor fate data



CHALLENGES (CONT)

- Wide range of items and surfaces in homes to consider
 - Lack of authority to regulate indoor cleanup
 - **Resources** Involves multiple federal, state and local agencies, often reinventing the wheel
 - Requires repeated visits for sampling, cleaning, resampling, recleaning, more sampling...



WITHOUT ADEQUATE CLEANUP PROCEDURES

 Occupants continue to inhabit contaminated buildings with no information about how to correct it

OR



Property is left vacant until the issue is addressed

OR



 Attempted cleaning spreads the contamination or creates more toxic breakdown products

CASE STUDY-CINCINNATI

 On June 1 2010, a handyman hired by a duplex owner began spraying for a bed bug infestation of the building





- The handyman told the residents:
 - he was "applying 3 to 5 gallons of malathion at 2-3 times the label strength, twice a day for 5 days"
 - he would "have to take his dogs somewhere else during the 5 day treatment or they would die" and that his family would "have to wear shoes when they were in the house"

- Children were aged 2, 3, 4, and 6 at the time.
- A resident contacted poison control on the third day of the treatment because his family (2 adults and 4 children) were experiencing acute health effects





- The resident also reported:
 - The first treatment left a wet residue in the house, and the family developed headaches from the smell
 - After the second treatment, the resident's son developed severe diarrhea
 - His family vacated the home on the second day of treatment



http://artkoni.com/sozaias.html

 The residents were permanently evacuated by the Cincinnati Health Department and referred to area hospitals for immediate treatment





- The families presented with headache, nausea, vomiting, dizziness, and tremors
 - Both families in the duplex were tested and treated for malathion poisoning at the hospital

 The Ohio Department of Agriculture (ODA) responded and collected seven wipe samples from the duplex. Samples were collected from the surface of four mattresses, two sofas, and a table top (no template was used, but the presence of malathion was confirmed).

Initial malathion wine sample results on surfaces in residences (lune 4, 2010)

Description	Result (µg)*
Control Sample	ND
Single mattress/Upper East Bedroom	472.80
Infant mattress/Upper Room East	581.09
Mattress/Upper Room West	536.95
Couch Cushion/Living Room	40.699
Mattress/Lower Bedroom	30.791
Table Top/Living Room	7846.58
Couch Cushion/Living Room	1165.56

- Additional wipe sampling using a 10x10 cm template, and VOC sampling occurred within the following weeks
- The owner chose to hire a contractor to remove porous surfaces and clean the duplex units with bleach and water
- Bleach can result in the oxidation of malathion to the much more toxic breakdown product malaoxon and is not recommended. The "cleanup" only served to spread around the contamination



- The range of malathion post initial cleanup was ND to 445.5 µg/100 cm² in a hallway floor
- The range of isomalathion post initial cleanup was ND to 61.4 $\mu g/100~cm^2$ on the living room floor

 Air concentrations for malathion ranged from ND to 2.1 µg/m³ post initial cleanup



- ATSDR recommended a cleanup target value based on a previously used criteria for methyl parathion incidents that occurred in R5 in the 1990s.
- This value was 15 µg/100 cm² and was believed to be protective due to the less toxic nature of malathion.



- ATSDR's cleanup recommendations included:
 - Porous materials: removal and disposal of objects within the home with porous surfaces, including: furnishings, carpets, upholstered furniture, mattresses, and wall panels
 - Nonporous materials: efforts are warranted to clean appliances and electronics. However, to ensure cleanup efforts were successful, postcleanup testing was recommended.
 - Flooring: ATSDR recommended the removal and disposal of all carpet and the thorough cleaning of all wood floors and linoleum.

Clothing and machine-washable window dressings: Studies indicate that several consecutive washes in a washing machine with prewash solution are effective for removing malathion from personal apparel and curtains. Dry cleaning is not recommended.

Children's items: toys and other objects handled by young children be disposed of to reduce the risk of additional exposure.









AGENCY ROLES AND COORDINATION

Cincinnati Department of Health handled the evacuation order and relocation logistics; maintained contact for health follow-up



- The local **Fire Department** enforced evacuation orders and posted no entry signs on units
 - The **property owner** is responsible for cleanup and decontamination

AGENCY ROLES AND COORDINATION

Ohio Department of Agriculture conducted misuse investigation, sampling, and analysis



- U.S. EPA assisted with pre-and post-decon sampling; provided oversight of sampling and decon plan
- The **Ohio Department of Health** and **ATSDR** provided technical public health guidance

SURVEILLANCE

 Several databases are kept that can provide information about the magnitude of this issue:
 National Pesticide Information Center (NPIC)



- Sentinel Event Notification System for Occupational Risks (SENSOR)
 - State Poison Control Centers

- ATSDR Requested a query of all pesticide cases referencing "bed bugs" from Jan 2006-Dec 2010.
- NPIC reported 169 calls to their hotline over the past five years where residents, homeowners, or pesticide applicators sprayed pesticides indoors to treat bedbugs.
- Cases involved pesticides that were misapplied, not intended for indoor use, or banned.

- Of the 169 calls, 129 caller reported mild or serious health effects, and one death for people living in the treated residence.
- Most cases involved more than one active ingredient, and most were overuse or misuse of approved indoor products.



 144 of 169 cases involved Pyrethrins, Pyrethroids, or both (85%)



13 of 169 cases involved banned or outdoor pesticides (8%)

- Of the calls fielded by NPIC the following symptoms were reported:
 - Dermal: 38% (n=65)
 - Neurological: 35% (n=59)
 - Respiratory: 24% (n=41)
 - GI: 14% (n=23);
 - Ocular: 8% (n=13);
 - Cardiopulmonary: 7% (n=11)





Bed Bug Inquiries by State 2006-2010 (*source: NPIC Database)



 Between 2006 to 2010, there was an increase in annual calls to NPIC of 837.5%

Number of Bedbug Related Calls



Source: National Pesticide Information Center (http://npic.orst.edu)

SENSOR DATABASE

- SENSOR is a database that collects statistics on pesticide exposures in 11 states.
- A review of SENSOR data involving bed bugs from 2003-2010 was published in the MMWR (9/23/11, Vol. 60, No. 37 titled, "Acute Illnesses Associated with Insecticide Use to Control Bed Bugs-Seven States, 2003-2010")
- These cases are a mixture of occupational and residential exposure, and also indicate a rapidly escalating public health issue

SENSOR DATABASE

- Study findings:
 - 111 cases were reported in 7 states during the time period
 - The majority occurred in 2007-2010 (73%) and were of low severity (81%)
 - The majority occurred in private residences (93%); 40% occurred in multiunit housing.
 - Among cases, 39% occurred in homes that were treated by occupants who were uncertified

SENSOR DATABASE

- Additional findings:
 - The majority of exposures involved pyrethroids, pyrethrins or both (89%)
 - The most frequently reported health outcomes were neurological (40%); respiratory (40%); and gastrointestinal symptoms (33%).
 - 12% of cases were occupational, 88% were residential

POISON CONTROL CENTER DATA

- Given the data from National Databases, we wanted to determine whether higher resolution, higher volume data being collected in states reflected similar trends
- In 2009, 605 cases were related to applications from licensed PCOs, an additional 2,856 were listed as general calls regarding pesticide exposures; it is unknown how many of those are related to bed bugs or other pests

2009 Annual Report of the American Association of Poison Control Centers' National Poison Data System (NPDS): 27th Annual Report

• The national poison data system (NPDS) has no narrative search capability; individual centers have to be queried



- Improved outreach on bed bug management and proper pesticide use
- Indoor screening values for household surfaces
- Indoor pesticide fate and cleanup information
- Resources for responding agencies

NEEDS

- Explicit language on labels prohibiting use indoors and clear directions on how, when, where to use it on various indoor surfaces
- Bed bug outreach should include information about the consequences of misuse beyond potential health effects i.e. loss of household items, financial burden to remove and replace building materials

RESOURCES

- CDC Bed Bug Website <u>http://www.cdc.gov/parasites/bedbugs/</u>
- EPA Bed Bug Website http://epa.gov/pesticides/bedbugs/
- EPA Bed Bug Pesticide Product Search Tool http://cfpub.epa.gov/oppref/bedbug/
- CDC/EPA joint statement on bed bug control http://www.cdc.gov/nceh/ehs/Publications/Bed _Bugs_CDC-EPA_Statement.htm

MANY more....



ATSDR: Michelle Colledge at (312) 886-1462 Email: mcolledge@cdc.gov

<u>U.S. EPA</u>: Amy Mysz at (312) 886-0224 Email: <u>Mysz.Amy@epa.gov</u>