

Liability

Identification, Treatment, and Prevention of Bed Bug Infestations for Property Owners

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Abstract

This report describes the liability issues relating to bed bug infestations for property owners. It provides a description of bed bug biology, reviews, identification strategies, and treatment methods. The identification and treatment for bed bug infestations is a global problem impacting many types of occupancies including offices, dorms, nursing homes, hotels and others. There is no one treatment method that is 100% effective, so a combination of risk control measures is required to eliminate bed bug infestations.

Introduction

Bed bugs have made a worldwide comeback, turning up in fancy hotels, college dorms, nursing homes, airports, even workplaces. While bed bugs do not transmit disease, these tiny, nocturnal, bloodsucking insects can seriously harm property owners by upsetting occupants, generating bad publicity, or triggering legal issues. Property owners should consider that avoidance or inaction, when it comes to bed bug infestations, may have an exponential effect on the harm done to their business.

For example, a hotel spent \$60,000 to treat an advanced bed bug infestation. But the hotel also lost revenue while the infested rooms were being treated for infestation. Bed bug infestations have triggered a variety of high-profile lawsuits, some seeking significant damages. In one case, a federal judge upheld a \$382,000 award to a brother and sister who were bitten by bed bugs at a Chicago motel. Examples of litigation are available in the Appendix, see Exhibit 1.

An individual bed bug claim has limited physical damage; however, the reputational risk; potential lost income and litigation damages can be costly. Prompt identification and effective treatments are essential risk control measures for property owners. This report focuses on how to identify, treat, and prevent future bed bug infestations. Tapping into ongoing research and lessons learned from treating infestations, the report provides a review of current detection methods and recommended protocols available to control bed bug populations. An overview of bed bug biology and the unique features of this insect are provided before addressing treatment options.

Bed Bug Behaviors

Bed bugs are nocturnal human parasites. They feed exclusively on blood and prefer humans to other potential hosts. Roughly 20% of humans display an allergic response (appears as a red, itchy bump on skin) to bed bug bites. An allergic response may be apparent in a few hours or appear up to two weeks after exposure. They avoid light and reside in tight cracks or crevices near a potential host. This is why they'll often be found in mattresses or near a bed. Typically, the bed bug feeds between 3:00 and 5:00 AM, when there is little disturbance or movement. At room temperature (~ 70°F or 21°C), bed bugs can live from four to six months without a blood meal — and even longer at cooler temperatures. And since bed bugs are transferred via infested personal belongings, it is not possible to prevent their entry into facilities. Due to their reclusive nature, it is difficult to inspect for and treat bed bug infestations.

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Figure 1. Bed Bugs at Various Stages of Development (Fed and Unfed)

Photo: Courtesy of [National Center for Healthy Housing](#)

Bed Bug Identification

As seen in the photo, bed bugs are small, and identifying their presence is challenging. It is essential that the identification of bed bugs be confirmed before treatment methods are selected. And, even more importantly, inspecting for bed bugs will allow for treatment before the property has a bed bug infestation. Treating for an infestation can be time-consuming and costly. And, because the bed bug lifecycle shows several stages of development, there may be times when the bug is not visible and therefore eludes treatment. The inspection process should be thorough and, initially, focused on the bedroom. The intent is to look for signs of bed bugs, check for their hiding places, and ultimately to confirm the presence of the insect. There are three methods used for identifying bed bug populations, each with unique costs, benefits, and challenges. They are:

- Visual Inspections
- Canine Inspection Services
- In-Room Monitors

Visual Inspections

Visual inspections are the most practical and cost-effective way to detect bed bug activity. With adequate education from a Pest Management Professional (PMP), staff members are the most effective line of defense against bed bugs. They can spot bed bug activity before occupants notice it. However, when bed bug activity is identified, a trained professional from a PMP should be contacted to provide recommendations on treating the infestation. PMPs should conduct visual inspections to validate staff member concerns when activity is suspected. By communicating frequently with a PMP, a property owner can address concerns before they become larger problems.

See Client Handout [CH-40-19](#), *How to Inspect for Bed Bugs*, for more information.

Canine Inspection Services

Dogs can be trained to inspect potentially infested areas based on a characteristic scent emitted by bed bugs. Companies that market canine inspection services highlight the speed of service and their ability to detect light infestations (less than 10 bugs) that could possibly be overlooked by humans, or those located within wall voids or other inaccessible areas. Even if a trained canine detects bed bug activity, it may not be able to identify where the infestation is located. While canine inspections detect small numbers of bed bugs, a traditional treatment schedule is still required to eliminate them once they are detected.

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In-Room Monitors

Bed bug monitors have been developed as in-room devices that are designed for detecting, monitoring, and trapping bed bugs. The monitors are intended to remain in the room at all times. The monitors use CO₂, heat, and/or pheromones to attract bed bugs to the device, and glue or pitfall traps to catch the insects. Such devices may be alarming to guests and will not prevent them from being bitten.

The monitors pose some practical challenges, such as the unit requires servicing daily; because the unit catches the bug, they are alive when caught — making handling the unit difficult for property staff and causing concern among room occupants and employees. And, lastly some industry research has shown that due to the slow-moving, cautious nature of bed bugs, pitfall traps and glue boards are not effective. Nonetheless, in-room monitors serve a useful function for the identification of bed bugs.

Treatment Methods

Once the presence of bed bugs has been confirmed, a property owner must take reasonable steps to protect occupants from bed bugs. Such steps may include frequent inspection of sleeping rooms and public areas for tell-tale signs of bed bugs (e.g., brown spotting, insects, their cast skins, and eggs near crevices, etc.), prompt corrective action when pests are identified, and institution of an integrated pest management (IPM) program with a reputable PMP.

An IPM program is defined as a decision-making process that addresses a wide spectrum of pest problems and human health concerns. The process is considered ideal for dealing with bed bug infestations because there is no one solution to eradicate the bug. IPM relies on collaboration. Team members include the property owner, administration, housekeeping and maintenance staff, occupants, the PMP, and their team. Together, they design flexible, site-specific plans scaled to the severity of the problem. Because recordkeeping is part of any effective risk control program, actions taken should be recorded in a log.

If bed bugs are suspected or confirmed in a particular room, a PMP should be hired to do a thorough survey for more bugs and, if they are found to be present, to establish a treatment program. IPM's approach to pest control relies on regular monitoring and recordkeeping to determine if and when treatments are needed. Biological, cultural, physical, mechanical, educational, and chemical methods are used in site-specific combinations to solve a pest problem. Chemical controls are used only when needed and in the least-toxic formulation that is effective against the pest. Educational strategies are used to enhance pest prevention, and to build support for the IPM program.

An extensive description of bed bug treatment methods is provided in Appendix, Exhibit 2, *Summary of Bed Bug Management Methods*. Some particulars of the following treatment methods will be described in this report:

- Clean and make other repairs to the living area to reduce hiding spots.
- Vacuum to physically remove bed bugs and eggs.
- Establish barriers to keep bed bugs from settling into hiding spots.
- Use steam, high heat, or cold treatments to kill all life stages of the bed bug.
- Chemicals applied by a PMP in addition to the methods listed above are sometimes needed to effectively treat infestations.
- Preventing re-infestation.

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Cleaning

Once the presence of bed bugs is confirmed, the cleaning begins. Vacuuming is an effective way to remove bed bugs and the dirt that provides them with shelter. Eliminate clutter and organize the bed, bedroom, other living areas, furniture, and belongings to reduce bed bug hiding spots. Bed bug hiding spots are quite creative; they have been found hiding behind peeling wallpaper and paint; on furniture; even in the spaces between floor boards or tiles. By caulking or sealing cracks and crevices around the room, the hiding spots will be eliminated. These types of repairs will limit the bed bugs from travelling along routes created by the openings. It is also important to seal any openings where pipes or wires or other utilities pass through walls or floors into other rooms.

The New York State Integrated Pest Management Program of Cornell University recommends salvaging items whenever possible. Furniture, linens, and pillows can be treated to kill bed bugs. Once cleaned, they should be placed in clear plastic bags and sealed to limit chances of re-infestation. The treatment methods are described below.

Vacuuuming

It's recommended that each area be vacuumed thoroughly and daily. The mattress, box spring, and furniture should be tilted upside down to reach all sides when vacuuming. Be sure to vacuum seams, creases, folds, and around any tufts or buttons. As part of the cleaning procedure, vacuuming using a High Efficiency Particulate Air (HEPA)-equipped machine that is dedicated only to pest control is recommended. Although a regular vacuum is acceptable, a HEPA-equipped vacuum will reduce the spread of allergens (approximately 20% of the population is allergic to bed bugs). A crevice tool will be necessary to vacuum and direct suction in small spaces where bed bugs might be hiding. Bed bugs have been known to cling to wood and fabric, and the eggs are cemented to the surface where they are laid. When the crevice tool is used with a scraping motion, it dislodges bed bugs or eggs. After each use, remove the vacuum bag and dispose of it in a sealed plastic bag. Store the pest control vacuum in a large plastic garbage bag that is closed tightly.

Barriers

While cleaning and vacuuming serve an integral purpose, other barriers help limit and deter bed bug infestations. A mattress protection cover that zips closed all the way around also limits the bed bug's ability to crawl into the bed. This is a preventive strategy used by some property owners to limit the chance of a bed bug infestation. Some of the literature indicates that sticky traps may be useful for monitoring the presence of bed bugs but its use will not help control bed bug infestations. Their effectiveness is disputed, and they can be messy.

Other barriers that limit the spread of bed bugs include using risers that elevate and isolate a bed leg; spreading diatomaceous earth (DE) around the perimeter of the room and sealing openings between rooms (to insects, DE is like a razor, the razor-sharp powder cuts into a bug's shell-like skin, killing it).

Make the Bed an Island

Bed bugs do not fly or jump, so crawling is their only option to move from point A to point B seeking shelter or food. To limit chances of a bed bug infestation, move the bed away from the wall; arrange the linens, bed skirt, and blanket so that they don't touch the floor; and isolate the legs of the bed to thwart the bed bug's ability to crawl from the floor onto the bed. See below for a visual display of these recommended practices.

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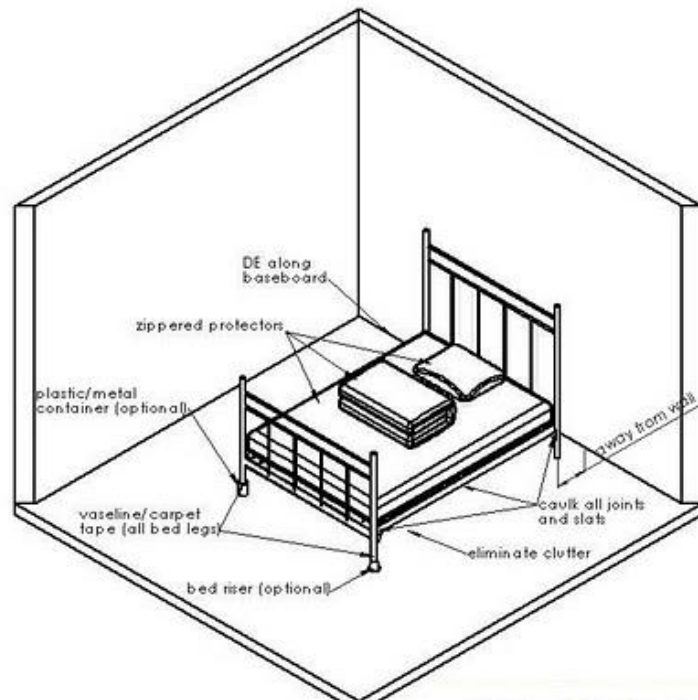


Figure 2. How to Make the Bed an Island

Heat

Bed bugs in all life stages are sensitive to extreme temperatures. Exposure to extreme temperatures, including heat, is lethal to all life stages of bed bugs. Effective control is based on the temperature achieved and the length of exposure. According to a study conducted by Insect Control Research Laboratories in July 2004, temperatures of 115°F (46°C) must be held for at least four hours in order to effectively kill all bed bug life stages. This is difficult to achieve due to concrete slabs, a common floor material, which commonly absorb the heat. The treatment time is adapted by extending the allotted time or increasing the treatment temperature to treat the bugs.

Laundering bed linens and drying them using very high heat is a way to treat for bed bugs rather than tossing out the bedding. Specifically, they recommend placing sheets, pillowcases, and blankets into a hot dryer (140°F/60°C) for twenty minutes to kill bed bugs. The linens should be placed in disposable bags and transferred to the laundry. Once the items have been laundered, they should be placed in clear plastic bags and sealed to limit chance of re-infestation.

For other items, there are two methods of heat treatment: off-site trailers and whole room structural heat. Furniture and contents are transported to off-site trailers where the heat treatment is performed. After treatment, the furniture and contents are returned to the room. This method is labor-intensive. It also exposes the spread of bed bugs to non-infested areas during transportation. The bed bug population in the room must still be eliminated by other means or the furnishings will become re-infested.

Extensive industry research suggests that whole-room heat treatment is not a practical method for eradicating bed bugs in hotel rooms. Whole-room treatments are labor-intensive and costly, due to the fact that heating an entire room to 115°F (46°C) for 4 hours demands tremendous amounts of energy. Some of the problems associated with whole-room treatment include: protecting or removing fire sprinklers, potential damage to sensitive furniture items and overall ineffectiveness. It has been found that the high heat is uncomfortable to the bed bug so they relocated to cooler locations, actually spreading the population to non-infested areas.

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Chemical Applications

Pesticides are an important tool in the fight against bed bugs; however, they should be applied by a licensed and well-trained PMP. Incorrect use of pesticides for bed bugs poses several risks:

- Overexposure to pesticides can cause or exacerbate already existing health issues.
- Children are more susceptible to toxic effects of pesticides than adults.
- People tend to treat places where they see bed bugs, including the bed, which may result in more pesticide exposure.
- Unskilled use of pesticides can result in the spread of bed bugs into adjacent rooms.
- Bed bugs are developing resistance to pesticides used against them.
- Over-the-counter treatment options have not been found effective, and bed bugs become resistant to the chemicals further reducing their effectiveness.

Foggers and other treatment options are particularly discouraged. Recently, the EPA released guidance instructing companies holding registrations for certain products used in, or as, indoor total release foggers to include a statement in bold font, in the directions for use, indicating that the fogger does not control bed bugs.

Only a few types of pesticides are available for use against bed bugs. They come in different formulations (liquid, aerosol, dust) but many have the same mode of action. They include: liquid insecticide for treatment of moldings, carpet edges, cracks, and crevices. Aerosol insecticides are used to treat bed frames, box springs, furniture, cracks and crevices. Dusts, that may or may not include an insecticide compound are used in cracks and crevices, inside walls, and behind electrical outlet covers and switch plates. The contents of a property can be placed in a container and treated with a fumigant, which is different than a fogger. As previously mentioned, foggers, commonly called “bug bombs” are liquid aerosol insecticides that are released into the air of an indoor space and are **not** effective for bed bug control.

Preventing Re-infestation

The learning curve regarding how to prevent re-infestation of bed bugs has been steep. Unlike treating for some other insects, one treatment is simply not sufficient. And neither is treating every day. What has been found effective by various governmental and research organizations is reinspection of infested areas about 10-21 days after initial treatment and again, 10-21 days later. The Armed Forces Pest Management Board requires this protocol to detect and precisely target the treatment of any continued infestation.

Limited-Treatment vs. Multi-Treatment Protocols

According to research conducted at the University of Kentucky and at Virginia Tech, products currently labeled for bed bug control are not 100% effective. A single treatment is likely to fail due to limited efficacy against the egg stage, product degradation, and the potential to overlook critical areas. A multi-treatment protocol is the most effective solution to control bed bug populations. This approach is designed to target both the reproductive lifecycle and the behavior of bed bugs. Ecolab has performed extensive research regarding treatment efficacy and has concluded that if one or more treatment steps is skipped, then the efficacy of the bed bug IPM program may be jeopardized.

Treating Adjacent Rooms

The National Pest Management Association recommends that all adjacent rooms (above, below, and to the sides) should be treated in addition to the infested room. Health departments, research institutions, and

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Other government organizations across the country recognize the need for adjacent room protocols as well. There are five principal reasons for treating adjacent rooms:

- The reclusive nature of bed bugs causes them to seek harborage in very, very small cracks and crevices. This behavior allows them to easily migrate through wall and ceiling joints that may appear seamless.
- According to industry research presented at the 2007 Entomological Society of America annual meeting, there is a 20% to 25% chance that adjacent rooms will also harbor bed bug populations.
- Housekeeping, maintenance, and other staff, and their equipment are “carriers” between infested and non-infested rooms.
- The repellent nature of available treatment products may cause bed bugs to migrate.
- Properly treating a bed bug infestation will help reduce liability risk with guests.

Bed Bugs at Work

The behavior and ecology of bed bugs in office settings are different than in hotels, apartments, or dorms. In general, the information described above is based upon bed bugs concentrating around sleeping and resting areas; in offices, the bugs wander and spread into less predictable locations. In the occupancies noted, bed bugs feed and mate, and populations increase primarily through reproduction; in offices, populations tend to grow slowly, primarily through new introductions. In occupancies that offer lodging, populations can increase to high numbers; in offices, the total number of bed bugs is typically low. While bed bugs are active and feed at night in certain occupancies, this changes in the office setting. Initially, the bed bugs are active at night but, since they typically cannot find hosts to feed upon in an office, they may shift their activity to daylight hours.

According to the authors of the *Bed Bug Handbook*, management needs to make many tough decisions when dealing with the issues associated with bed bugs in an office setting. If these issues are not addressed properly, the risk of failure increases. Decisions are best made through a team approach, i.e., consulting with the office community and the PMP. Here are some considerations from the authors for addressing bed bug infestations in the workplace:

- **Disclosure and Education.** Should information about the bed bug infestation be disclosed to the office community? If so, what specific information and to how wide an audience? What methods should be used to educate the office community (seminars, fact sheets, websites, etc.)?
- **Resources for Workers' Homes.** What assistance, if any, will be provided to workers to deal with bed bugs at home? Examples include education (through handouts, seminars, etc.), free or partially subsidized home inspections and home service, encasements, interception devices, and use of portable heating units.
- **Scope and Intensity of Service.** Which areas of the office will be serviced? How many service visits will be scheduled? What will be included in the service (insecticide applications, heat treatment, steam treatment, cold treatment, vacuuming, etc.), to which sites and how intensive will it be? What actions will be taken to deal with the files, computers, personal items, etc. contained within individual office spaces? Examples include doing nothing, having the items heat-treated or fumigated, or having them isolated and inspected by a canine detection team.
- **Ongoing Monitoring.** Once service has been completed, how will the office be monitored to detect new infestations (see How to Inspect for Bed Bugs) and for how long?

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Preventing Re-Infestation

Property owners must act promptly, according to their defined IPM program, to maintain a zero-tolerance policy for bed bugs. The importance of communication cannot be overstated as part of an effective IPM program.

See Client Handout [CH-40-18](#), *Safety Tips for Property Owners to Protect Against Bed Bugs*, for more information.

All members of the IPM team should be in communication about pest control issues and resolutions. Property owners should review leases, tenant handbooks, housekeeping standards, and pest control policies to ensure these documents contain language articulating tenant and property management roles and responsibilities for pest control. Management should use unambiguous language to describe pests of concern, such as bed bugs, and what constitutes an “infestation” that must be reported to management. Documents should contain clear language about pest prevention and the requirement for tenant cooperation with the IPM and PMPs. In addition to helping occupants understand their responsibilities regarding pest management, such clear written language in leases and other key documents can be useful should enforcement action be required in the face of tenant non-compliance.

An effective IPM program addresses all the reasons bed bug control efforts fail. Inspection, cleaning, and re-treatment over the course of several weeks should lead to control of bed bugs. Incorporating best practices, such as attentive inspection during vacuuming or maintenance work will help to identify the potential of the presence of bed bugs.

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Appendix: Figures and Tables**Exhibit 1. Examples of Bed Bug Litigation**

The courts have dealt with bed bug problems for more than one hundred years. Most of the early cases held that the tenant was responsible for abating the problem. This is no longer the case. The following summary of recent cases should convince any property owner to prepare a bed bug infestation prevention plan.

- *Mathias v. Accor Economy Lodging*, 347 F.3d 672 (7th Cir. 2003). A brother and sister staying at Motel 6 in Illinois claim they were bitten by bedbugs. They brought suit against the property owner. The jury awarded each person \$5,000 in compensatory damages and \$186,000 in punitive damages. (37:1 ratio). They claimed that the motel was not a “flop house,” therefore guilty of “wanton and willful conduct” which allowed punitive damages. The infestation had reached “farcical proportions.” The staff was instructed to call bed bugs “ticks” because the owners felt it would “alarm the customers less.” The rooms were rented even though they’d been put on “Do not rent until treated” and “Do not rent, bugs in room” status.
- *Ludlow Properties vs. Young* (Civil Court City of NY) (2004) Infestation in apartment building; Young’s studio apartment was infested; Young was bitten several times and had problems sleeping. Ludlow Properties sued for failure to pay rent. Young claimed breach of warranty of habitability as defense. The court agreed, awarding \$3,632.50 in damages for partial rent, giving 45% credit for uninhabitability. Young did not abandon the property, nor claim constructive eviction. The court considered several factors in determining abatement of rent: the size of the premises; the severity of the infestation; and the landlord’s diligent effort to eradicate the condition – the tenant’s continued use of the premises left the door open for a constructive eviction claim.
- In 2004, Helmsley Enterprises reportedly paid a guest \$150,000 to settle a bed bug claim.
- Also in 2004, a judge in New York ruled in favor of a frustrated tenant who refused to pay rent for six months because of persistent bed bug problems.
- *Livingston vs. H.I. Family Suites*, 19 Fla. L. Weekly Fed. D 1069 (2006). A husband, wife, and child sued the hotel for gross negligence, for bites due to infested room. The hotel’s log was used to show that they were aware of the infestation. Just 15 days prior to the Livingston’s visit, another guest in the same room had complained of infestation. In the two weeks prior to their visit, four other complaints were received on the same floor. The judge denied the defendant’s motion to dismiss fraudulent concealment – concealment by omission – the hotel did have a duty to warn of bed bugs in hotel; the matter was to proceed to trial. It was settled shortly thereafter.
- *Huynh & Nguyen vs. JC Penney* (July 2008). Plaintiffs ordered \$1600 in furniture in 2006; after months of bites, unsure what causing them; ended up with infestation in home; the jury verdict – they were awarded \$49,000.
- *Stepanek vs. Wichita State University* (2007). A mother and son claim lightheadedness and nausea associated with overexposure to pesticides following treatment for bed bug infestation in campus housing (apartments). The claim indicated that doctors said the son was “2 hours from dead” and she was “2-12 hours from dead” due to exposure. Claims stated both campus maintenance and pest company were spraying. Mother has been diagnosed with benign tumors in her lungs, allegedly due to exposure.
- In 2007, a woman sued for “pain, mental anguish, embarrassment, and humiliation, medical bills and expenses” after an alleged bed bug incident.
- In 2008, a Fox News employee has sued the landlord of her company’s office building, saying she got bed bug bites at work. The lawsuit filed May 29, 2008 in Manhattan’s state Supreme Court, alleged that she picked up the bugs in the mid-Manhattan tower that houses the New York Post and the Fox News Channel. Defendants named in the suit were Triangle Maintenance Service Inc. and American Quality

Appendix: Figures and Tables

Cleaning Corp. The building owners and managers are Beacon Capital Partners LLC, 1211 6th Avenue Property Owner LLC, and Cushman & Wakefield.

- In 2008, an opera singer initiated a lawsuit against the Hilton Corporation for \$6 million dollars alleging over 150 bed bug bites.
- A family sued the Storer YMCA camp in Napoleon Township, Michigan because their son brought bed bugs home with him from camp in 2008.
- *Dorrity v. Grandview Terrace* (6/09). Grandview Terrace is a senior citizens building. William Dorrity was bitten over a period of months; the lease requires tenants to pay costs of extermination. The exterminator charged \$299 per visit. The landlord delayed treatment over 30 days. N.J. Superior Court ruled in favor of plaintiff; landlord appealed; the Court ruled that the obligation for treatment belongs to the landlord.
- *Scott vs. La Coquille Motel* (Virginia Beach, 9/09). A mother seeks \$100,000 for bites to her son who “suffered itching, rashes, pock marks, scarring, humiliation, and embarrassment and remains injured permanently...” The property owner claims the son had scabs when they checked in and mom said it was chicken pox. The city health department has received two complaints of bed bugs this year at this hotel – on the subject of this lawsuit; this owner has been sued for bed bugs in other hotels he owns.

Other bed bug lawsuits have been filed against cruise lines, rental furniture companies, laundromats, and dry cleaners. It is expected that soon there will be addendums to lease agreements holding tenants responsible for bedbug infestations.

Appendix: Figures and Tables

Exhibit 2. Summary of Bed Bug Management Methods*

| Management Method | Primary Responsibility | Retail Cost/System | Comments | Compatibility with Other Methods |
|-------------------|---|--|---|--|
| Laundering | Resident | Dissolvable Bag: \$22 for 10 | Laundered fabrics will be free of bed bugs as long as they are kept isolated from infested areas. | Include in every control method |
| Unit Preparation | Resident | Varies | Poor housekeeping, sanitation, etc., are not necessarily conducive to bed bug infestations, but bed bugs are more likely to remain undetected and pest control efforts are more likely to fail in a cluttered room. | Include in every area so that the Pest Management Professional (PMP) can properly inspect the property. |
| Encasements | Resident | \$80 for mattress and \$50 for box spring | Bed bugs that are trapped in an encasement designed for use in bed bug control will not be able to feed or escape and will eventually die. Encasements keep bed bugs from infesting mattresses and box springs. | Use encasements either after treatment or before infestation is found. |
| Monitors | PMP, resident, or staff | 4 interceptors for \$8. Carbon dioxide attractant devices \$15-\$950 initial cost. | Monitors will catch bed bugs, but are not meant to control infestations. | Monitors can be used alone or in combination with other detection and control methods to confirm active bed bug infestations. |
| Vacuuming | PMP, trained staff, or trained resident | HEPA Vacuum for \$250 - \$500 | Vacuuming is not reliable as an exclusive control method. | PMPs, staff, and residents should use a vacuum to remove bed bugs during inspections and unit preparation. |
| Steam | PMP or trained staff | \$500 - \$1500 | Steam wand must be moved at a rate that heats the area to a lethal temperature. | Use with other methods, such as insecticidal dust for voids that steam cannot penetrate. Mattresses and box springs must be dry prior to encasement. |

Appendix: Figures and Tables

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| Thermal Remediation Using Ambient Heat | PMP or trained staff | \$330 for luggage-sized container. \$800- \$2,000 to treat an apartment. | Lethal temperatures must penetrate all items for the treatment to kill all stages of bed bugs. | Heat treatment is a good option for cluttered spaces where preparation is a struggle. |
| Management Method | Primary Responsibility | Retail Cost/System | Comments | Compatibility with Other Methods |
| Bed Bug Detecting Canine | PMP | \$10,000 to purchase. \$1300 per team per day. | Dogs are effective and efficient large-scale (multi-unit) inspections. | Use with visual inspection. Treat in areas where dog alerts. |
| Pesticides | PMP | Varies by product. | See analysis; consider the residual ovicidal properties of each product before selecting it. | Pesticides are used as needed in combination with other treatment methods. |
| Freezing Using Dry Ice | PMP | \$6,900 for a machine | Not widely used in the U.S. but widely used in Europe. Insufficient information to assess at this time. | More research is needed comparing the penetration of both heat and cold. |

***Table reproduced from National Center for Healthy Housing, “*What’s Working for Bed Bug Control in Multifamily Housing: Reconciling Best Practices with Research and the Realities of Implementation.*”**

