Identification

Prior to undertaking any treatment, a positive identification of the pest should be made by a professional. IPM treatment is tailored to the specific pest. Most pest management companies can provide this service. Pest identification services are also available to the general public in Michigan through Michigan State University Diagnostic Services.

Treatment

Controlling bed bugs requires a significant investment of time and resources. **Bed bugs can be eliminated** with a coordinated effort that includes cooperation of the resident and pest management professional (PMP), or the resident, landlord/property manager, and PMP. There is no single tool or activity that, used alone, will eliminate bed bugs, including pesticides. Multiple techniques are always required because bed bugs are small, good at hiding, and can survive long periods of time without feeding. Despite the challenges, the technology of bed bug control is getting better and elimination of a bed bug infestation is achievable. The components of a sound treatment plan include:

- Education
- Reporting and Record Keeping
- Pre-treatment
- Treatment (both non-chemical and pesticides)
- Post-treatment Assessment

Educating Residents and Staff

The administrators and facilities managers of apartment buildings, group homes, dormitories, homeless shelters, and other types of housing should seek to better educate residents about bed bugs and how to prevent them. The Michigan Bed Bug Working Group offers fact sheets on bed bugs to educate the public. These fact sheets are available at www.michigan.gov/bedbugs. In addition, non-profit associations such as the Michigan Pest Management Association and/or its member firms offer bed bug training programs. This manual also contains fact sheets for resident education in the Appendices section.

Reporting and Recordkeeping

It is critical for managers of multiple-unit housing of any type to encourage residents to report suspected cases of bed bugs to the facility manager. If a bed bug problem is not addressed immediately, it will grow quickly and spread throughout the facility room by room. Eliminating a widespread problem is MUCH more expensive and difficult than a limited one.

Bed bugs and other pests sometimes elicit fear and panic in people. Most are unwilling to live with pests, especially those that bite. However, some individuals are resigned to living with bed bugs and may be the source of an infestation in an adjacent unit or room. **Encourage residents to speak openly about bed bugs** and other pests and to ask for help. Be sensitive to their concerns. Complaints about pests or bites must be handled IMMEDIATELY, but also with a logical approach that relies on science and pest control expertise.

Designation of a pest management coordinator in your organization can streamline the handling of complaints and infestations. The typical course of events would be receipt of a complaint, inspection (of one or many units), confirmation, cleaning, treatment, future prevention, and follow up to be sure the problem was handled adequately. There should be one person in charge of overseeing the inspection and treatment process. Often this is the building or facility manager. Use resources available to you, and gather the contact information of experts, such as your pest control company's staff entomologist, to ensure a quick response.

Management should keep records of the following for all types of pests:

- Date of the complaint
- Type of complaint (bites, bug sightings, damage to property)
- Unit or room number
- Date of first pest inspection
- Results of the inspection, what was found, how much was found
- Dates of pest management activities
- What pest management strategies were used, such as cleaning, pesticide treatments, resident education

Recordkeeping Requirements for Licensed Pest Management Firms and Certified Commercial Pesticide Applicators in Michigan

The recordkeeping requirements for licensed pest management businesses and certified commercial pesticide applicators are outlined in State of Michigan regulations and are available in Appendix H of this manual.

Isolating the Bed

(To help reduce bites immediately)

A couple of simple steps can dramatically improve the quality of life for a resident in an infested apartment. These steps can help reduce bites from bed bugs while a treatment plan is initiated or is ongoing:

1. A thorough vacuuming of the apartment is recommended to reduce the number of bed bugs present, especially in the sleeping areas and around and under the bed.
2. Headboards and bed frames should be carefully inspected and cleaned of any signs of bed bugs or eggs. They are easily cleaned and scrubbed with standard household cleaning agents.
3. Encase the mattress and box spring to prevent bed bugs from reaching residents.
4. The bed should be moved away from the wall, bed skirts should be removed and bedding should be prevented from touching the floor to prevent bed bugs from climbing onto the bed.
5. Once it is thought that there are no bed bugs on the headboard, frame, and mattress, petroleum jelly or double-sided tape on the legs of the bed can prevent bed bugs from crawling up from the floor. Residents can also place a plastic dish with a thin layer of cooking oil below the legs of the bed to trap bed bugs as they try to climb to the bed. These techniques may be more difficult with platform-style beds.

Pre-Treatment Preparations

Preparation of a living area for bed bug elimination should focus on containment of the infestation through cleaning, organizing, repairs, and physical barriers. Do everything possible to avoid spreading bed bugs to new locations.

A combination of the following steps will be needed for bed bug control:

- Clean and organize the bed, bedroom, other living areas, furniture and belongings, focusing on the elimination of clutter.
- Physically remove bed bugs and eggs using a vacuum.
- Isolate the bed (see above), using barriers, such as mattress encasements and sticky barriers (sticky traps may be useful for monitoring but will not help control bed bugs).
- Eliminate bed bug hiding spots
    - Fix peeling wallpaper or paint
    - Caulk or seal cracks and crevices around the room and on furniture
    - Seal floors or the spaces between floor boards or tiles
    - Make other repairs to the living area to reduce hiding spots
- Employ professional pest management that uses a combination of chemical and non-chemical methods to eliminate a bed bug infestation.

It is important to consider that a bed bug infestation in a living area (bedroom, apartment, dormitory room, shelter room or unit) might spread to adjacent units or those below, above or to the sides. This is especially true if the population is high or if pesticides are used in the original unit. Adjacent units should be inspected and if bed bugs are found or residents report bites, they should be treated as if infested and the above measures should be applied.

Cleaning and organizing a room or home

Cleaning and organizing a room or home for bed bug management can be as burdensome as changing residences. It is, however, an extremely important first step to control bed bugs, because bed bugs will thrive in a cluttered living area. Vacuuming and cleaning should be done before chemical or non-chemical treatment. Cleaning should be carried out in a systematic way, beginning with removing items from the infested room or home. Soap or detergent will aid

WARNING! When chlorine bleach is mixed with acid or ammonia, it produces toxic gases that can harm you.

You can't always tell if a cleaning product contains bleach, acid, or ammonia, so for safety's sake, never mix cleaning products together!

in the clean up of bed bug debris and allergens, making the environment healthier and more tolerable for those living there. Bleach and ammonia may kill bed bugs if sprayed directly on them, but their vapors can also be harmful- USE CAUTION, and **NEVER mix bleach and ammonia!**

Steps to follow include (preparation for heat treatment may involve different steps):

- Scan the room for items on the floor. Make a plan for each item, and how it will be quarantined (closed into a plastic bag, for example), inspected, sanitized of bed bugs, and stored until further notice.
- Place clothes, shoes, plush toys, pillows, and bedding into large clear plastic bags and seal them tightly to be laundered.
- Empty furniture items for better inspection
- Plastic tote bins that have an airtight seal can be used for items that cannot be laundered, such as hard toys, electronics, books, breakable items, etc. Be prepared to store these items for a period of time until they can be thoroughly inspected or enough time has passed that bed bugs are dead – at least a year. Another method is to have these items treated in the container, consult a PMP for guidance.
- Launder all clothing and bedding (it is recommended to use the highest heat settings for washing and drying if possible)
- Move furniture away from walls

In places such as shelters, long term care facilities, institutional child care centers, and camps, cleaning teams or the facility management may be responsible for the majority of housekeeping duties. Cleaning for bed bugs should focus on sleeping and lounging areas (whereas cockroach control depends on sanitation in cooking and eating areas). However, for cleaning to have any impact, the resident must cooperate by reducing clutter, organizing, and bagging their belongings. There may be a need to store their belongings temporarily. Be certain every item is bagged until it can be cleaned of bed bugs. Units should always be cleaned and inspected before new tenants move in.

Vacuuming

A cleaning procedure for bed bugs begins with vacuuming, using a HEPA-equipped vacuum that is dedicated only to pest control. Although a regular vacuum is acceptable, a HEPA-equipped vacuum will reduce the spread of allergens. A crevice tool will be needed to focus suction in small spaces, cracks and crevices. A brush attachment can also be used but must be cleaned carefully to prevent the spread of bed bugs. See below for proper handling of the vacuum cleaner and vacuum bags:

Handling a bed bug vacuum

A vacuum used for bed bugs can have live bed bugs inside and it will be important to avoid transferring bed bugs to new locations.

- **Dedicate a vacuum for the purpose of pest control in multi-unit housing facilities**
- If used only for pest control, after each use, remove the vacuum bag or container and dispose of the bag or container contents in a sealed plastic bag.
- NOTE: A knee-high stocking can be placed on the hose of the vacuum prior to the bag or container. The knee-high stocking will capture bed bugs and larger particulates before they reach the bag. If this technique is used, it may not be necessary to replace the vacuum bag after each use. However, the knee-high stockings should be replaced between each use, sealed in a plastic bag, and discarded.
- Clean the brush attachment with hot water and detergent.

- Store the pest control vacuum in a large plastic garbage bag that is closed tightly.
- Inspect the vacuum before each use to be sure no live bed bugs are on the outside.

Vacuuming procedure

- Once the room has been “stripped” of all personal belongings, begin vacuuming the bed, paying special attention to the mattress seams.
- Use a brush or crevice attachment with a scraping motion to dislodge bed bugs or eggs.
- Remove the mattress and box spring from the bed frame and inspect and vacuum all surfaces, removing all loose debris and visible bed bugs.
- Flip the bed frame over and vacuum any crevices where bed bugs may hide. This is especially important for wooden bed frames and captain’s beds.
- Vacuum inside and under drawers of night stands, dressers, and other furniture.
- Turn over each piece of furniture and vacuum the under side of each.
- Pay attention to screw and nail holes.
- Vacuum along the bottoms of all walls and the moldings. If molding or wallpaper is loose, lift or remove and vacuum underneath.
- Make sure to vacuum around heating units.
- Vacuum along carpet edges.
- Vacuum plush furniture with a carpet-beater attachment or by patting the furniture while vacuuming to flush out bed bugs.
- If a vacuum brush attachment is used it is possible some live bugs or eggs could be caught in the brush bristles. Wash the vacuum brush with hot water and detergent if this is a concern.

Washing Surfaces and Furniture

- Wash all furniture (non-plush) and hard surfaces in the room using a detergent cleanser. Pay attention to crevices and spaces in the frame.
- After removing the mattress and box spring from the bed frame, wash the bed frame liberally with soap and water.
- Wash cribs and children’s bed frames with soap and water rather than using pesticides.
- Wash the floors, moldings, window sills, and walls generously.
- Steam can be used as well. **Do not use liquids or steam on electrical wiring or equipment.**

Rugs and Carpeting

- Many small rugs can be placed into the dryer on a hot setting for 30 minutes.
- If the room has a large area rug, the rug can be steam cleaned within the same time frame that other bed bug control measures are taking place, although steaming should be done before pesticide applications are made. Rugs can be sent out for professional cleaning as well. Wrap in plastic for transport and advise the cleaning company that bed bugs may be present.
- Wall to wall carpeting can harbor bed bugs and should be removed, especially in a heavy infestation, or steam cleaned, paying very close attention to the edges. Prior inspection will help determine where to concentrate steaming efforts. Carpeting may also be treated with a labeled pesticide.
- If carpet is removed or replaced, attention should be paid to the carpet tack strips as they can provide harborage for bed bugs.

Mattress Encasements

Mattress encasements are zippered enclosures that cover the entire mattress. Encasing both mattress and box spring eliminates the need to discard bedding by trapping bed bugs inside and providing a smooth simple outer surface that can be inspected, vacuumed and cleaned easily. Encasements should always be used for non-vinyl mattresses and box springs for bed bug prevention and management. Special bed bug-proof encasements are made of high quality cloth material that does not tear easily and has no folds around the zipper that might shelter bed bugs. Cheaper vinyl encasements are available but need to be installed carefully to avoid tears. If a small hole appears, duct tape can be used to repair it. Holes MUST be repaired to prevent bed bugs from either gaining protection on the inside of the cover, or to prevent bed bugs from escaping from the infested bedding. **It is highly recommended that both mattresses and box springs be encased, to protect the sleeping area and to make bed bug inspections quick and easy.**

Physical repairs

Simple structural repairs are important in containing infestations, eliminating bed bug harborage, and preventing re-infestation.

- Moldings and joints around the room perimeter (floor, doors, cabinets, and windows) should be caulked with silicone sealant to eliminate hiding spots for bed bugs.
- Wall outlets should be inspected and repaired to minimize gaps.
- Openings around pipes or other structures that come through walls, floors and ceilings must be sealed to prevent bed bug movement to/from adjacent units.
- Peeling wallpaper should be repaired or removed.
- Cracks in walls or floors should be repaired.

Disposal of Infested Items

One way bed bugs are likely being transferred from place to place is through infested furniture and discarded objects. When a bed bug infestation is discovered, often the first step people take is to discard infested furniture and belongings. If infested items are discarded they should be wrapped in plastic before disposal and LABELED as “INFESTED WITH BED BUGS.” It is also good practice to destroy or deface the infested items to prevent others from unknowingly collecting and reusing them. Slash mattresses and plush furniture, break box spring frames, and label items with the words “bed bugs” to prevent the spread of bed bugs in your community.

Non-Chemical Treatments to Eliminate Bed Bugs

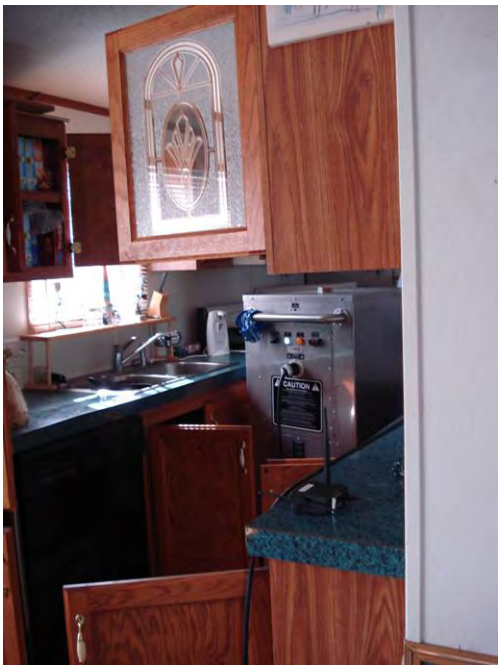
Steam treatment

Steam treatments, when properly applied, will kill all life stages of bed bugs, including the eggs, which are protected from the effects of most pesticides. It is recommended that a facility at risk of getting bed bugs invest in a steam cleaner for fighting bed bugs. Combined with pesticides and other methods, steam is very effective and can be used to reduce allergens and dust mites. Steam can be used on mattresses and plush furniture, such as couches and chairs. However, steam will only kill bed bugs in places where the steam can reach. Contact time for heat is also critical. Move the steam cleaner nozzle slowly (20 seconds per linear foot) to maximize depth and time of exposure.

The best choice in a steam machine is a professional type with a large water-holding capacity, many types of attachments, and variable output rates. Dry-steam or low vapor steamers are better because they use and leave behind less moisture. Steam cleaning should be done before vacuuming because steam will flush bed bugs out of their hiding spots allowing them to be killed or vacuumed up. By reducing the number of live bed bugs vacuumed up, it also reduces the chance that the vacuum will become infested and spread bed bugs to new areas. Details of the use of steam for controlling bed bugs can be found in the book "*Bed Bug Handbook*" (Pinto, Cooper and Kraft, 2008). See the References section for more information.

Thermal Remediation Using Ambient Heat (Convection Heat)

Heat treatments come in many forms from clothes dryers to heating units capable of treating an entire house. Heat has the advantage of killing all stages of the bed bugs lifecycle. In Michigan, whole unit thermal remediation using ambient heat, and compartment heat treatments are becoming more widely available. Whole unit heat treatments usually use a series of heat generating equipment and fans to circulate super-heated air within a unit. This "convection heat" method of bed bug control has shown much promise. The entire unit is brought up to a temperature that does not harm most belongings, but is deadly to bed bugs and their eggs. In multiple-unit facilities, however, room/unit inspections must be done on adjacent units to prevent bed bugs from re-infesting the unit following heat treatment.



Freezing and the Use of Dry Ice or Liquid CO_2

The use of cold temperatures or freezing is often recommended as a method to kill bed bugs, however its effectiveness can vary. It has been shown that some bed bugs can recover from being frozen if not subjected to temperatures low enough or for long enough. Studies have shown that freezing bed bug infested items at <0°F for two or more hours is effective. Using this method, it takes approximately 8 hours for 5 pounds of dry laundry to REACH 0°F. Many items, however, can not be treated with this method due to size or item type. A new rapid freeze technology called Cryonite™ has been developed. This method uses carbon dioxide snow to rapidly freeze and kill bed bugs. It is applied in much the same way that steam is used, primarily as a crack/crevice treatment. This technique leaves no pesticide residue. This system is available in Michigan.

Use of Pesticides

Pesticides are an important tool in the fight against bed bugs. However, they should be applied by a licensed and well-trained pest management professional (PMP). In Michigan, people who apply pesticides for hire or as part of their employment must be certified or registered by the Michigan Department of Agriculture (MDA). Businesses that apply pesticides for hire must also have a business license. Use of pesticides alone will not eradicate a bed bug infestation. Pesticides are most effective when used in the context of an Integrated Pest Management program, as outlined above.

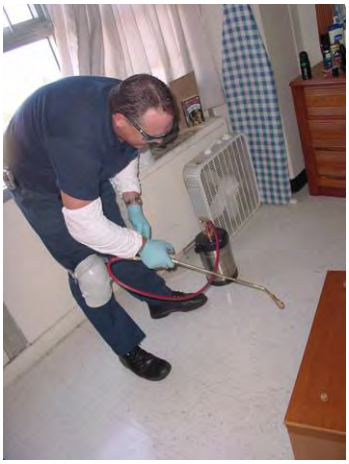
Pesticides available for sale in Michigan should be registered with the Michigan Department of Agriculture. There are many over-the-counter products readily available to the public. Pesticides must be approved for use against the pest listed on the label, and contain clear instructions on how the product can be used. People may also obtain remedies from the internet, many of which are not safe, effective or legal.

Residents of multi-unit housing should not attempt to do their own pest control. Local ordinances may prohibit the application of pesicides by tenants in government housing. Pesticide applications made by residents could impede the effectiveness of the building's bed bug treatment program and cause bed beds to become resistant to pesticides. Residents should contact their building management to report pest problems and should be reminded to follow the guidelines for cleaning and room preparation.

Incorrect use of pesticides for bed bugs poses several risks:

- Over-application of, or overexposure to pesticides can cause serious health effects or exacerbate existing conditions.
- 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 pesticide overexposure.
- Unskilled use of pesticides can result in the spread of bed bugs into adjacent rooms and units.
- Bed bugs are developing resistance to pesticides used against them.
- **It is illegal.**

When bed bugs appear in a home, multi-unit housing facility, or communal living facility, it is best to hire a pest management professional and work closely with them to manage bed bugs safely and effectively. The PMP will conduct an inspection to confirm and locate bed bugs. They will then make recommendations for preparing the home/room/unit for treatment. Cleaning should be performed before pesticide treatment.



Only a few types of pesticides are available for use against bed bugs. Thoroughly read and follow the labeled directions of the pesticide and ensure that the site of application (mattress, apartment, bedroom, etc.) is listed on the label. Pesticides come in different formulations (liquid, aerosol, dust) but many have the same mode of action. Some low-risk products are available. Consult a PMP for information about treatment choices. The types of pesticides that are commonly used for the control of bed bugs include:

- Liquid insecticide for treatment of moldings, carpet edges, cracks and crevices
- Aerosol insecticides for treating bed frames, box springs, furniture, cracks and crevices.
- Dusts (that may or may not include an insecticide compound) used in cracks and crevices, inside walls, behind electrical outlet covers and switch plates.
- Fumigants are gases used for treating whole buildings, or for container treatments of the contents of a home. Fumigants are different than foggers.
- Foggers, commonly called “bug bombs” are liquid aerosol insecticides that are released into the air of an indoor space. **They are not effective for bed bug control.** The use of these methods has also been linked to acute pesticide toxicity in people through misuse, insecticide resistance in bed bugs, and is suspected to promote the dispersal and potential spread of bed bugs through repellency.

What to Look for When Hiring a Pest Management Professional

- The pest management company must be **licensed by the state** and insured. A list of currently licensed pest management companies in Michigan is available at www.michigan.gov/bedbugs.
- Technicians must be either certified or registered pesticide applicators in general pest management (Category 7A) with the MDA. Technicians are issued a credential by MDA and should be able to display this credential upon request.
- The company should be a member of a professional organization, such as the National Pest Management Association, or the Michigan Pest Management Association.
- The company should have a staff entomologist or access to one.
- Technicians should have experience with bed bug management.
- Choose a company based on their quality of service, not the price. Get several proposals for service if possible and compare them.
- A pre-inspection should be conducted to assess the scope of the work.
- The proposed work should follow the steps of **Integrated Pest Management**, not just pesticide application.
- Technicians should be straightforward and open when discussing details of their service.
- Understand what guarantees are being offered. Bed bug management may be difficult to guarantee, because re-infestation from an outside source is possible.
- A licensed pest management firm is required to provide you with the information listed in Appendix H, under Regulation 637, Rule 12.

Post-Treatment Evaluation

Bed bug management is a time consuming and difficult task. To rid a household of bed bugs in a timely manner it is important to evaluate the effectiveness of the treatment methods being used and adjust to the best strategy. After physical repairs, cleaning, and treatment have been conducted it is important to monitor for surviving bed bugs. Whether using conventional, heat, or a combination of methods, there may be surviving eggs that will hatch. This does not mean the treatment is ineffective. As these eggs hatch it will be necessary for continued monitoring and follow-up treatments. Expect the treatment to progress over several weeks. Monitors

(sticky traps, bed bug interceptors) are useful in these situations. If a significant reduction in bed bugs is not observed after the first treatment, it may be necessary to consider a combination of methods or an alternative to the one being used. Reasons for treatment ineffectiveness may be:

- All sources of bed bugs were not identified during the inspection phase
- All sources of bed bugs were not treated. Consider re-inspecting adjacent units (they should be inspected prior to treatment)
- Ineffective insecticides, or insufficient contact time by heat methods
- Re-introduction by infested items – Do not move items out of the home or area to be treated before you consult your pest management professional. They may harbor bed bugs which may not be treated.

If a decision is made to move during the course of a bed bug mitigation program, please see Appendix K "How to Move and Leave Bed Bugs Behind".