

An Integrated Pest Management Program for Managing Bed Bugs

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Introduction

Bed bugs have become prevalent in the past few years – in homes, apartments, hotels, etc. such that any person may have to deal with an infestation of bed bugs. Although bed bugs can carry many viral diseases, they are not known to transmit these diseases when they take a blood meal from a human. The reason for this is not clearly understood but it seems these viruses do not behave the same way in bed bugs as they do in mosquitoes that can pass the viruses on to humans. The disgrace, isolation, fear and related health, economic and social implications of a bed bug infestation can be overwhelming. This document is applicable to all stakeholders who live in or manage residential and commercial dwellings, the pest management industry and other industry and government agencies and the most vulnerable people in society. This document outlines bed bug prevention through education of clients, residents, facilities managers, and landlords and provides an educational resource for professionals and service providers such as visiting nurses, social workers, tradespersons and others who must, as part of their job, visit or come into contact with persons who have a bed bug infestation.

Strategies that DO NOT work

Although people with a bed bug infestation often consider abandoning rooms or even whole premises this action will not eradicate bed bugs. An immature bed bug that takes just one blood meal can mature into an adult without feeding again and live for more than a year. Bed bugs will also crawl to find a new host that includes humans and other animals.

Simply discarding beds and bedding is **not** a sound approach to bed bug management. Bed bugs are likely in crevices, voids in walls, behind mouldings, cracks in ceilings, inside light fixtures, electronics, TV remote controls, alarm clocks, spaces within and along floor boards, and the edges of carpets etc. Bed bugs will move from these sites to infest new furnishings brought in to replace the infested items.

Do not use “bug bombs” or total release foggers since these applications do not penetrate the cracks and crevices where bed bugs hide and will produce poor results. This practice may cause bed bugs to become resistant to pesticides and contribute to their increase and widespread occurrence. It may also result in increased pesticide exposure to the resident. Do not use unregistered/unclassified products, home remedies or pesticides not labelled for bed bug management.

Strategies that DO work

An Integrated Pest Management (IPM) program is the most effective program for eliminating bed bugs because it utilizes all necessary methods, minimizing the risk of pesticide exposure by reducing the necessity for repetitive pesticide use and safeguards the indoor environment by maximizing the effectiveness of bed bug management options.

An IPM program places emphasis on prevention. IPM programs will only work when there is a strong commitment by the resident, pest management service providers, property owners and support agencies (e.g. agencies that assist seniors, people in low income housing, persons with disabilities, and those agencies that promote public health etc.). An IPM program requires all parties to maintain their responsibilities to ensure the continuity of a successful program.

An IPM program for bed bug management includes the following eight components:

1. **Planning** the IPM program preferably before there is a bed bug problem.
2. **Educating** everyone **and raising awareness** of bed bug habits including where bed bugs can hide, the need to reduce clutter and proper disposal of untreatable items with an emphasis on prevention.
3. **Identifying** the pest correctly.
4. **Inspecting** all living areas for potential or suspected infestations.
5. **Keeping records**, including when and where pests are found.
6. **Preparing** for treatment.
7. **Performing treatments** using several methods to manage bed bugs including physically removing bed bugs, steam treatment or use of pesticides according to label directions.
8. **Evaluating** the IPM program and following up with inspections and additional management procedures if necessary.

A major component of an IPM program includes prevention through education of clients, residents, facilities managers, and landlords. This education component also includes the training of professionals and service providers such as visiting nurses, social workers, tradespersons and others who must, as part of their job, visit or come into contact with persons who have a bed bug infestation.

Managing a bed bug infestation in apartment buildings, hotels, hostels, dormitories, hospitals, long-term care homes etc., can be very challenging. Each party has a certain responsibility for an IPM program to be effective.

Responsibilities of Landlords, Building Management and Staff:

- Institute an IPM program, with emphasis on awareness and prevention.
- Consider requesting that new tenants report that they are moving from a bed bug infested premises* .
- Consider acknowledging to potential tenants before leasing units that bed bugs have been identified in the building and an IPM program is in place*.
- Encourage tenants or guests to report bed bugs and keep records of bed bug or other pest complaints on site in a log book.
- Respond quickly to all complaints.
- Refer tenants and guests to the appropriate support agencies (e.g. medical, mental health, financial, and social services) for help if necessary.
- Obtain the services of a licensed pest management company with experience in managing bed bugs using IPM principles. Request tenants follow instructions from the pest management company.

* Privacy and liability issues need to be taken into consideration. Although these items are mentioned for consideration, they are voluntary not mandatory. It is recognized that a new tenant is unlikely to admit to moving from a bed bug infested premises in apprehension of being refused rental accommodation. Similarly, it is doubtful a landlord will want to admit his or her building has a bed bug problem.

- Provide information on how to properly remove bed bug infested furnishings to prevent the spread of bed bugs along hallways and in elevators and to ensure use of proper disposal methods.

It is important to note that some operators of residential facilities may have specific responsibilities under the law. For example, operators of Long Term Care Homes are legislated to have an organized pest management program using the services of a licensed exterminator. The Home must keep records of dates of visits and actions taken. *Long Term Care Homes Act, 2007 – O. Reg. 79/10 section 88 (1)*.

Responsibilities of Tenants:

- Read and follow all advice and instructions to support the IPM program implemented by the building management even if you do not have an infestation of bed bugs.
- Report bed bugs and keep records of bed bug or other pest complaints in a log book and provide this information to the building management.
- Know the signs of bed bugs and check your living space frequently for evidence of them.
- Encourage discussion with neighbouring tenants to support the IPM program in place and cooperate with management.

An Integrated Pest Management Decision Flow chart for Bed bugs is outlined in **Appendix 1**. Depending on the level of infestation, several cycles of various management methods, for example, inspection/preparation, vacuuming, steam treatment/vacuuming, cleaning, and pesticide use according to label directions, may be necessary to manage bed bugs. The right side of the flow chart provides an example of an IPM strategy if a person were to determine that the bed bug threshold level is zero (i.e. one bed bug is one too many).

Implementing an IPM Program for Bed Bugs

There are eight main components for an effective IPM program. An IPM program should be in place to deal with pests including bed bugs before they are a problem.

1) Planning the IPM Program

It is important to set an acceptable threshold or tolerance for bed bugs. In most situations people can tolerate a few ants or flies in their home; however, even a low infestation of one bed bug in a home is not usually tolerated. An IPM program must have a plan with set goals and it is important to share these plans with others. These goals need to be monitored in order to assess the program and provide an evaluation of its success. It is critical for managers of any type of multiple-unit residential, commercial or industrial facility 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. Managing a widespread bed bug problem is much more expensive and difficult than a limited one. Prevention and early detection strategies are much less costly than ignoring the problem and having to incur the costs of managing a heavy bed bug infestation.

2) Educating Everyone

The administrators and facility managers of homeless shelters, group homes, dormitories, apartment buildings, and other types of residential housing, commercial and industrial facilities should seek to better educate residents and staff about bed bugs and how to prevent them. Many facilities in the hospitality industry have used the professional services of a pest management company to train their staff. Additional information is available on the internet (see **Appendix 2** – Additional Reading). Your [local public health unit](#) may also be able to provide you with additional information.

Preventing a Bed Bug Infestation or Re-infestation

Bed bugs can easily be transported to anyone's home as a result of travelling or bringing infested items into the home.

Travelling:

Bed bugs can easily be brought into premises as a result of encountering them during travelling. Hotels, buses, ships, student dormitories, or even visiting a home with bed bugs can be a source of introduction into premises. Visitors may bring bed bugs with their luggage or other infested material.

Regardless of where one stays while travelling, the sleeping quarters, adjacent furniture and luggage stands should be inspected as recommended in this document. Clothing should be kept inside luggage instead of using dressers and closets. Consider encasing the luggage in large plastic bags to prevent bed bugs from hitching a ride home. Some retailers sell special bags to encase luggage for this purpose. Also, inspect all luggage prior to leaving and before taking the luggage into the home. It may be advisable to leave luggage in an outdoor area or garage, place all contents in plastic bags and then make a thorough inspection of the luggage and contents prior to bringing these items indoors. Bed bugs can often be found in buses, ships, aircraft and automobiles where luggage is temporarily stored.

Used Furniture:

Second-hand items are another potential source of introducing bed bugs to a home. This includes electronics, exercise equipment, mattresses, furniture and lamps, which are often placed at the curb for garbage pickup. Used clothing and furniture stores, garage sales or flea markets are potential sources of bed bugs if pests are hidden in any items purchased from infested premises. When purchasing used items from these sources ask what policy is in place to ensure items are bed bug free. Once the items are purchased, place them in plastic bags before loading them in your car as bed bugs can also survive in the car and carefully inspect all items before taking them into the home.

Moving and Storage:

Bed bugs can also be introduced from moving trucks and vans supplied by rental companies or moving companies. There is also a potential of bedbugs moving from infested mattresses or items stored in storage rental facilities. Ask what the company policy is to ensure that bed bugs are being managed at these facilities. If no policy is in place then encasing items during storage or moving may be an alternative.

Other Preventative Measures:

Bed bugs thrive under certain conditions which are enhanced by the availability of hiding spots close to their human hosts. Bed bugs have a preference for paper, fabric and wood, rather than metal and plastic as they can climb up these materials easier. Paper, fabric and wood have porous surfaces and provide egg-laying locations for bed bugs.

The following guidelines are more pertinent for institutional settings but can also be considered by residents who want to take preventative measures against a bed bug infestation.

- Replace wood frame beds with metal frame beds to discourage bed bug from hiding and egg-laying. Metal frames are also not as easy for bed bugs to climb.
- Move beds away from walls as the wall can provide a bridge for bed bugs to contact the bed.
- Eliminate head boards completely. Bed bugs hide and thrive in head boards. Wicker head boards or furniture is discouraged due to the numerous hiding spots for bed bugs.
- Consider replacing all plush furniture with metal and plastic, or items easily cleaned with soap and water.
- Consider replacing larger pillows or cushions with smaller cushions that can be placed in a dryer. Cushions should be dried on a hot setting if bed bugs are found. Use only white or light coloured sheets to easily detect blood stains from feeding bed bugs.
- Use wooden baby cribs, but choose models that are painted white. Paint existing wood-coloured cribs white. Fill gaps in the frames with silicone caulk. This will allow for much better inspection and reduce need for treatment. Place bed bug interceptors under legs (see page 9 for additional information and a photograph of a bed bug interceptor).
- Vinyl-covered or seamless mattresses are recommended for cribs and adult beds although vinyl can easily rip. These mattresses are commonly used in institutional settings rather than residential homes.



A metal bed frame and vinyl mattress will minimize bed bug problems if moved away from the wall.
Photo by Black Widow Pest Control

- If vinyl mattresses have holes, consider repairing them with tape or discarding them.
- Do not discard regular (non-vinyl) mattresses, only to replace them with other regular mattresses. Bed bugs will re-infest the new bedding quickly.
- Use mattress encasements. If a box spring is being used, be sure to encase it too. The box spring is more likely to harbour bed bugs than the mattress. Encasements are also less costly than replacing a mattress and box spring and eliminate the need to treat the mattress and box spring with pesticides. Remove bed skirts as bed bugs can use these to climb up to the mattress.



Use mattress and box spring encasements.

- In institutional settings, wooden dressers, wardrobes, tables and other furniture can be painted white for easy inspection.
- Any crevices where a credit card will fit should first be sealed with silicone caulking to eliminate hiding spots for bed bugs.
- Consider using diatomaceous earth (silicon dioxide) dust applied into wall voids and other cracks and crevices where bed bugs can hide. Follow the pesticide label directions (see Use of Pesticides on page 20).

3) Identifying Bed Bugs

Ensure the pest is actually a bed bug. An untrained person can easily misidentify cockroach nymphs or pantry pests as bed bug nymphs. Confirm that what you find is a bed bug by consulting with an entomologist or a pest management company. Your local [Public Health Unit](#) may be able to assist with identification of specimens.

Signs of Bed Bugs:

- Bed bugs nymphs range in size from a poppy seed to an apple seed and adults range in size from an apple seed size to much larger when engorged with blood.

- Droppings in the form of dark coloured stains or bumps on hard surfaces usually found on bed linen but also on any other surface where they feed or hide.
- Shed skins because bed bugs moult between the five nymph stages.
- Eggs, although very small and adhered to surfaces, will be found among droppings or in crevices where adults and nymphs hide.
- Bed bug bites. Bite reactions look very different from one person to another. Some bed bug bites are large or small welts, some have a red dot in the centre, or a scab, others don't, and some look like mosquito bites or pimples. Often bites are in groups where one bed bug has begun to feed, been disturbed and starts feeding again. Some may be just single bites. Persons who have a suppressed immune system may not show any bite reactions.
- Since bed bug bites may be mistaken for other pest bites or stings (e.g. fleas, mosquitoes, black flies, wasps, etc.) it is recommended that you consult a health professional if in doubt.

4) Inspecting All Premises

A thorough inspection of the premises is recommended before any cleaning or rearranging has occurred. An initial inspection provides a sense of the full extent of the problem and prevents the disturbance and spread of bed bugs before treatment.

Some professional pest management companies will perform a visual inspection to determine where bed bugs are most predominant. Some companies use trained dogs to sniff out viable eggs and bed bugs (see page 14). This should always be followed up by a visual confirmation of live bed bugs. Adult bed bugs can hide in cracks and crevices as thin as a few sheets of paper. Young bed bugs can hide in even smaller spaces. When conducting an inspection, move slowly to avoid disturbing hiding bed bugs, so they don't scatter. Keep in mind that with low infestations, the bed bugs will be concentrated close to sleeping areas. Items away from the sleeping area will be less likely to be infested. Prioritize inspection areas from high to low levels of infestation and focus inspection and treatment in the most heavily infested areas.

Look first before touching furniture or other items to avoid injury from hidden sharp objects e.g. staples used to affix a fabric dust cover to the underside of the box spring.

It is important to consider that a bed bug infestation in a living area (e.g. bedroom, apartment suite, dormitory room, shelter, room or hospital or long-term care unit) might spread to adjacent rooms or units or those below, above or to the sides. This is especially true if the bed bug population is high or if pesticides are used in the room or unit where the bed bugs were originally discovered. Adjacent units should be inspected and if bed bugs are found or residents notice bites, they should be treated as if infested.

Tool Kit:

A recommended bed bug inspection tool kit includes:

- Magnifying glass.
- Strong-beamed flashlight.
- Plastic vials or zip-top bags and forceps for collecting specimens.
- A putty knife, spatula or probe, such as a "credit card tool", made by cutting any plastic card into a long triangle, for checking in narrow spaces.

- Compressed air (e.g. used to clean computer key boards) for flushing bed bugs out of hiding (use carefully so as not to blow bed bug eggs, that have not been securely cemented to a surface by a female bed bug, to other areas of the room).
- Screwdrivers for removing light switches and electrical plates.
- A small tool kit for disassembling furniture.
- Cotton swabs, glass-cleaning or baby wipes for checking for dropping stains.
- Digital camera may be needed to take photographs with the occupant's permission.
- Sticky traps (may be of some use but have limitations for catching bed bugs).
- Interceptors placed under bed or other furniture legs to monitor bed bug activity.



Bed bug interceptor. Bed leg is placed in the inner section. Talcum powder is incorporated in the interceptor to prevent bed bugs from climbing out.

Interceptors:

Bed bug interceptors are a cost-effective inspection tool that requires no expertise to use. They provide early detection of low level infestations and can even prevent bites from occurring by providing a barrier between areas around the bed where bed bugs hide and the bed. As a bed bug crawls up and over the outside surface of the interceptor it will fall into the outer ring. Any bed bugs climbing down the bed leg will be trapped in the inner well.

Room Inspection

Bed bug inspections can be very labour intensive and cost may be an issue if conducted by a person other than the resident. The following inspection procedures should be carried out in a room until bed bugs are discovered. For example, if bed bugs are found on the mattress it may be unnecessary to continue inspecting the remainder of the bedroom as it can be assumed that bed bugs are present in all areas and all items and the bedroom and items treated accordingly.

Inspecting the Bed:

Inspection for bed bugs starts in the place where people sleep or rest and moves out from there to other parts of the room. This should be conducted before room preparation steps are taken.

This may require some heavy lifting of furnishing. Use caution and obtain assistance when required.

- Mattress inspection
 - Along the top and bottom seams, and along each side of the piping material.
 - Under mattress handles and along or inside air holes.
 - Between the mattress and box spring, platform or frame.
 - Inside folds of material and under buttons.
 - If mattresses are covered in vinyl plastic, look inside seams and rips in material.

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- Use alcohol or baby wipes to rub suspected bed bug droppings. If the spots dissolve into a reddish brown color, this could indicate bed bug droppings and should be a reason to continue inspecting until a live or dead bed bug is found.



Bed bugs may be found along piping seams, under pillow tops, between the mattress and box spring, inside air holes, or underneath mattress handles. Do not overlook tears in the fabric or stitching holes when inspecting for bed bugs. Photos by J. Gangloff-Kaufmann.

- If bed bugs are not found in the mattress begin a box spring inspection:
 - Points where the box spring sits on the bed frame (lift slowly to avoid scattering bed bugs).
 - The top surface of the box spring, inside folds of material.
 - Along seams and where the material is tacked to the frame.
 - Turn over the box spring and remove the thin cloth layer on the underside.
 - Use a flashlight, a hand lens and a crevice tool to check the spaces between box spring frame parts.
 - Remove bed skirts as these are a direct route for bed bugs to access the box spring.
 - Look around and beneath furniture staples and tacks and plastic corner protectors.
 - Use a flushing agent such as compressed air to move bed bugs out of hiding spots.
 - Double-faced tape or carpet tape can be placed on the underside of furniture to capture wandering bed bugs. This is a monitoring tool only



Check between the mattress and box spring and along every fold of material for signs of bed bugs
Photo by D. W. Coard.

- If bed bugs are not found in the mattress or box spring inspect the bed frame and head board:
 - Wood beds, especially captain's beds, and headboards, especially wicker, are preferred hiding spots for bed bugs over metal bed frames, but bed bugs will hide in crevices on metal and plastic, or where a mattress touches a metal frame.
 - Visually inspect and use the crevice tool in all joints of the frame where parts meet.
 - Turn the frame over and inspect the underside.

- Check screw and nail holes for bed bugs.
- Take the bed frame apart to check between parts.
- Remove the headboard from the bed and check for bed bugs along the joints and on the wall behind it.
- Wicker furniture provides infinite hiding spots for bed bugs. Anything made of wicker should probably be cold or heat treated or discarded.



Tiny spaces in the bed frame and other furniture, such as a peg hole for a shelf, are ideal hiding spots for bed bugs.
Photos by J. Gangloff-Kaufmann.

Inspecting Other Furniture and Storage Areas:

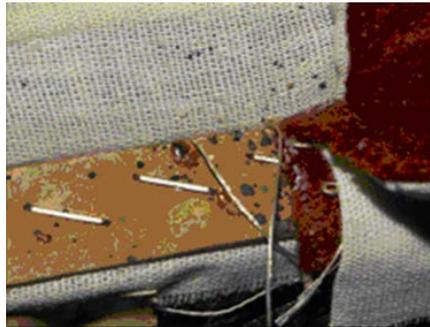
Furniture, such as night stands and dressers are likely places to find bed bugs, since they can easily crawl to distant hiding spots. As the bed bug population grows, overcrowding may cause bed bugs to crawl elsewhere in search of a hiding place. Furniture near the bed can become infested and an infestation can quickly spread away from the bed if no management measures are taken. The following steps should be taken to inspect furniture and associated items:

- Empty drawers and shelves of the furniture closest to the bed.
- Place items into plastic bags to be inspected and cleaned.
- Pull out drawers and inspect every corner and the undersides, using the crevice tool to check under the metal drawer guide.
- Use the crevice tool to inspect gaps wherever the tool will fit, such as between a shelf and bookcase frame.
- Turn over all furniture to inspect the underside.
- Be sure to inspect screw and nail holes.
- Plastic and metal furniture may harbour bed bugs: follow the same inspection procedures.
- Electronics, such as lamps, remote controls, alarm clocks, and radios should be placed into plastic bags for further inspection. If bed bugs are found in the frame of the furniture where the radio or clock sits, further inspections of those items and possible treatment are warranted.
- Office-style chairs should be inspected by turning them over and looking under seams where fabric attaches to the frame. Also, check screw holes for bed bugs that may be hiding.



Bed bugs hiding in the screw hole of an office chair.
Photo by L. Sorkin

- Plush furniture, such as a couch, may harbour bed bugs, even if residents are not sleeping there. In these cases, inspection will be more difficult due to the many inaccessible hiding spots.
- Inspect pillows and cushions, particularly the seams and the folds around zippers.
- Look at and under legs of chairs and couches.
- Turn over the furniture and remove the thin cloth backing under each piece. Pay special attention to areas where material is stapled to the frame.
- Look inside at all wood parts of the frame.
- If the piece is highly infested, consider having it placed in a container and heated (see page 20) or disposing of it in a proper manner (see page 15).



Bed bugs and faecal spots on the underside of an upholstered chair.
Photo by L. Sorkin

Inspecting the Room Perimeter:

Once established, bed bugs will spread toward the perimeter of the room, including walls, mouldings, and rugs.

- Look at mouldings or the joint between the floor and wall closest to the bed.
- Use the crevice tool to check behind mouldings. The tool will chase bed bugs out of hiding if used in a sweeping upward motion.
- Fold back the edges of wall-to-wall carpets to inspect for signs of bed bugs.
- Pay attention to the tack strip of carpets.
- Look under the edges of area rugs.
- Use a screwdriver to remove electrical switch, outlet, and phone jack plates for inspection. If bed bugs are hiding in these areas, signs may be evident along the edges and on the back of the plate. Use caution when inspecting electrical outlets or switches to prevent electric shock.

- Inspect everything hanging on the walls. If framed art or photos are present and there is evidence of bed bugs nearby, open the frame to inspect inside or under the paper backing.
- Check under loose wallpaper and areas of peeling paint.
- Check curtain pleats and seams and spaces where rods and hardware are inserted.
- Take down curtain rods and inspect inside them and underneath hardware on the walls.
- Examine closet, bathroom and other door frames, along hinges, and in the bore hole for the latch on each door.
- Ceiling lights and fixtures with bed bugs could indicate that they are moving from the upper floor.
- If bed bugs are on walls, they may also be under ceiling mouldings and in smoke detectors.

Inspecting Unusual Locations:

Bed bugs may turn up in unexpected places in moderate and large infestations. If the infestation is large, every object in the affected area should be carefully inspected. Bed bugs have been found in such locations as:

- Television and other remote controls, including the battery compartment[†].
- Telephones, cell and cordless phones.
- Lamps and alarm clocks[†].
- Computers and other electronics[†].
- Cardboard boxes, luggage, backpacks in closets and under the bed.
- Children's toys and stuffed animals.
- Jewellery boxes, ornaments and picture frames etc.
- Brick walls and "stucco" or other textured wall coverings.
- Books, magazines, newspapers, and files.
- Hollow doors.
- Ceiling and other light fixtures, sprinkler heads, and smoke detectors[†].
- Heating units, air conditioners[†] and ducts.
- Wheelchairs.
- Clothing of persons after carrying out a bed bug inspection.



Bed bugs hiding in the tab of a dictionary.
Photo by P. Stravino.

[†] Use caution when inspecting electrical components to prevent electric shock.

Bed Bug Detecting Dogs

Several companies in Ontario offer bed bug detection using dogs that are specifically trained to locate bed bugs. These services are another tool in the fight against bed bugs and can be especially useful in situations where bed bugs are suspected, but have not been located or in large areas such as theatres, stadiums, arenas or transit vehicles. The use of bed bug detection dogs may be more cost efficient when inspecting numerous multi-residential units compared to the labour costs of manual inspections. If it is known that there is a bed bug infestation in a number of units, using bed bug detecting dogs can determine how many units and which units, are infested to help decide the extent of treatment needed. The dogs are about 90-95% accurate but once detected it is advisable to follow up with a visual inspection to eliminate the chances of a “false positive” due to handler interpretation error. Combining the services of a bed bug detection dog with a trained pest management professional can lead to immediate results of finding and eliminating obscure harbourages. A two-dog system is often used to reduce the occurrence of false positives. Dogs can positively indicate a bed bug problem but it is unclear whether using a bed bug detection dog can absolutely rule out bed bugs, for example, if bed bugs are hiding in an area inaccessible to the dog. Dogs should not be expected to search in hazardous areas or where the handler cannot see objects that may harm or injure the dog. The dog handler team should be recognized by a certifying organization, such as the [National Entomology Scientist Canine Association](#) or other reputable bed bug detection dog associations.

5) Keeping Records

It is important to keep good records in an IPM program. Bed bug information records should be maintained by the pest management company or the landlord and indicate:

- Date of the complaint.
- Type of complaint including bites, bug sightings and damage to property.
- Unit or room number.
- Date of first pest inspection.
- Results of the inspection, what was found, level of infestation (e.g. low, moderate, high).
- Details on how well the area was prepared.
- Pest management strategies that were used, such as vacuuming, steam treatment/vacuuming, cleaning, heat or cold treatments or pesticide treatments.
- Follow up with residents to share information and inform on proper procedures to prevent re-infestation.

6) Preparing for Treatment

Once bed bugs are located and identified and the extent of the infestation has been determined, room or unit preparation must be done. Preparing and organizing a room for bed bug management can be as burdensome as changing residences. In most cases, room preparation is done by the resident; however, it may be carried out by a service provider or even the pest management company. It is, however, an extremely important first step to manage bed bugs, because bed bugs thrive in a cluttered living area.

The reduction of household clutter is absolutely necessary for managing bed bugs.

Preparation should be done in a systematic manner. Room preparation includes organizing belongings and placing them in bags, laundering all clothing and bedding, moving furniture away from the walls, and emptying furniture of items for better treatment.

The first step is to separate bed bug free items from infested items. Using plastic bags of different colours e.g. clear vs. green or tags, will help differentiate these items.

All **infested** items or those items suspected of being infested that can be:

- Laundered and placed in a clothes dryer should be placed in a plastic bag, sealed tightly and tagged as infested and laundered (in hot water (at least 45oC) then dried (on a high setting for at least 30 minutes).
- Dry cleaned (drapes, rugs, garments) should be placed in a plastic bag, sealed tightly and tagged as infested for dry cleaning.
- Treated by heating or freezing should be placed in a plastic bag, sealed tightly and tagged as infested for heat or cold treatment.

Empty all drawers, closets and remove all items from shelves, dressers and tables etc. and place in an appropriately tagged plastic bag.

Place all items that are **not infested** by bed bugs in plastic bags, seal tightly and tag as “bed bug free”. Move these items to a non-infested area. Note that it is possible that although no bed bugs are found their eggs may still be present in crevices in these items. It may be preferable to consider all items as possibly infested if a bed bug infestation is found in proximity to the room or unit.

The second step, in preparing an infested room for treatment, is to remove all drawers from dressers and bureaus and pictures from walls and place them on top or beside these furnishings. Move all furniture away from walls. Do not introduce any items into the infested room or remove any items, except for those encased or bagged and tagged as infested items until the room has been properly treated. For example, after laundering and drying sheets and pillow cases do not place them back onto the bed until the mattress, box spring and the entire room have been properly treated. If any infested item cannot be treated it is recommended that the item be discarded.

Disposing of Infested Items:

Encase infested articles destined for disposal in plastic bags or wrap and seal in plastic to avoid bed bugs from dropping off while transporting them to a garbage collection area. It is a good practice to demolish items to prevent others from unknowingly taking infested items. For example, slash mattresses and plush furniture, break-up box spring frames, and label bags containing infested items with the words “**Infested with Bed Bugs**” to help prevent the spread of bed bugs.

7) Performing Treatments

Managing bed bugs is a labour intensive, time consuming and costly activity; however, bed bugs can be managed with a coordinated effort of all responsible parties. Despite the challenges, the technology of bed bug management is improving. Pest management companies are becoming more knowledgeable as bed bugs become a greater issue. There is no single tool or activity that when used alone, will manage bed bugs, including the use of registered and classified pesticides. Multiple techniques are always required because bed bugs are small, good at hiding, and reportedly a bed bug that is getting nourishment on a fairly consistent basis within the average house can survive in excess of one year. Bed bugs are resistant to many of the pesticides used against them, allowing some to survive chemical treatment. When treating a living area for bed

bugs it is important to focus on containing the infestation. Do everything possible to avoid spreading bed bugs to new locations.

A combination of the following activities will be needed for bed bug management:

- Cleaning and organizing the bed, bedroom, other living areas, furniture and belongings, including elimination of clutter.
- Physically removing bed bugs, droppings and eggs using a vacuum. Some bed bug eggs can be removed by vacuuming, however, since they adhere to surfaces many eggs will likely remain.
- Using barriers, such as mattress and box spring encasements and interceptors, may be useful in reducing bites and harbourage and sticky barriers may be useful for monitoring purposes.
- Applying steam to kill all life stages along with vacuuming to remove dead bed bugs.
- Using thermal heat or cold treatments by a professional to kill all life stages.
- Eliminating bed bug hiding spots:
 - Fix peeling wallpaper and 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.
- Using pesticides:
 - Follow all label directions and precautions
 - Use only federally registered products classified for use in Ontario.
 - Contract the services of a professional who is trained in the proper use of pesticides (i.e. a Structural licensed exterminator).

Thorough cleaning, by vacuuming and washing floors and furniture, is an essential step in bed bug management. Cleaning alone will not eliminate bed bugs but it is necessary to crash high populations. Cleaning removes debris (e.g. bed bugs, droppings, and moulted skins) that may contribute to allergies and asthma, and removing this debris makes it easier to spot new bed bug activity. Vacuuming alone will not easily remove all eggs or bed bugs hiding deep inside cracks and crevices.

In places, such as commercial multi-unit buildings (e.g. hospitals, shelters, schools, office buildings etc.) cleaning teams or the facility management may be responsible for the majority of housekeeping duties. Cleaning for bed bug management should focus on sleeping and lounging areas. 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 resident's belongings temporarily. Be certain every item is bagged until it can be properly handled to remove bed bugs (e.g. placing clothing into freezer bags, removing air and freezing them for a month or heating them in a clothes dryer on a high setting for at least 30 minutes). Units should always be cleaned before new tenants move in.

Vacuuuming:

A thorough vacuuming of bed bug hiding places is necessary. Use a high efficiency particulate air (HEPA) filter-equipped vacuum that is dedicated only to pest management. Although a regular vacuum is acceptable, a HEPA filter-equipped vacuum prevents insect parts and droppings from becoming airborne and reduces the spread of allergens. A crevice tool attachment, to focus suction in small spaces, cracks and crevices, will be needed. Use the crevice

tool attachment with a scraping motion to dislodge bugs and eggs, since bed bugs cling to wood and fabric and the eggs are cemented to the surface where they are laid. A putty knife or similar tool should be used to dislodge bed bugs and eggs in cracks and crevices during vacuuming. 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.

- Once the room has been “stripped” of all personal belongings, begin vacuuming the bed, paying special attention to the mattress seams.
- Attach a crevice tool to the vacuum and use a scraping motion to vacuum surfaces and use a putty knife to reach into cracks.
- Remove the mattress and box spring from the bed frame, inspect and vacuum all surfaces to remove all loose debris and visible bed bugs.
- Flip the bed frame over and vacuum the cracks and 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 in the room.
- Turn over each piece of furniture and vacuum the under sides of each.
- Pay attention to screw and nail holes, using a putty knife to reach deep into crevices.
- Vacuum along the bottoms of all walls and the mouldings. If moulding or wallpaper is loose, lift or remove it and vacuum beneath.
- 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, some live bed bugs or eggs could be caught in the brush bristles. Wash the vacuum brush with hot water and detergent after use.

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 management.
- After each use, remove the vacuum bag and dispose of it in a sealed plastic bag or place it in a freezer until next use.
- Clean the brush attachment with hot water and detergent.
- Stuff a paper towel in the hose end or place a plastic bag secured with an elastic band over the hose end to prevent bed bugs caught in the hose from escaping or, if practical, detach the hose and wash it out with hot water.
- Store the vacuum in a large plastic garbage bag that is closed tightly.
- Inspect the vacuum before each use and catch any live bed bugs that remain.

Steam Treatment:

Steam treatments, when properly applied, will kill all life stages of bed bugs, including the eggs, which are difficult to manage with most pesticides. It is recommended that vacuuming occur before **and** in conjunction with steam treatment to remove bed bug droppings and moulted skins, lint, debris and even bed bugs. Vacuuming before a steam treatment will also remove dirt that could stain fabrics if mixed with the steam. A professional quality steam cleaning unit should be used to manage bed bugs.

Steam can be used on mattresses and plush furniture, such as couches and chairs to manage bed bugs but the steam must reach the areas where the bed bugs are hiding.

It is recommended that a professional type steam machine with a large water-holding capacity (at least 4 L), many types of attachments, and variable output rates be used. Dry-steam or low vapour steamers are a better choice because they use and leave behind less moisture. When steam is used it should be immediately followed up with or in conjunction with vacuuming. Steam will flush bed bugs out of their hiding spots to be killed or vacuumed. Use a wide nozzle instead of a single-holed nozzle as it may concentrate the steam into a jet that can dislodge bed bugs allowing them to escape the effects of the heat. Move the steam cleaner nozzle slowly to maximize depth. A person using a professional steam cleaner should monitor the heat output of the steam, using a thermal monitor, to ensure surface temperatures are at least 80°C after the steaming nozzle has passed that surface. Depending on the baseboard thickness and crevices available it may be more effective to use a nozzle tip to place steam behind the baseboard.



Steam treatment of the baseboard. Note that the wand is covered with a terry wash cloth to increase and retain heat.
Photo by R. Cooper.

Washing Surfaces and Furniture:

Soap or detergent will aid in the clean up of bed bug debris and allergens, making the environment healthier and more tolerable for those living there. Bleach and ammonia do not kill bed bugs and should not be used to manage them. Consider the following:

- Wash all furniture (non-plush) and hard surfaces in the room using a soap or 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 rather than using pesticides.
- Wash the floors, mouldings, window sills, and walls generously.
- Use caution to prevent electric shock when washing around electrical components.

Rugs and Carpeting:

Although rugs and carpeting, especially edges near baseboards, may provide hiding places for bed bugs professional cleaning of these items can be costly. Whenever possible consider using vacuuming, steam, heat or cold treatment if cost is an issue.

- Small rugs can be placed into the dryer on a hot setting for 30 minutes for cleaning or rolled and placed in a freezer for a month.
- For large area rugs, steam clean with other items or furniture being treated and before pesticide applications are made. Rugs can also be sent out for professional cleaning. It is

recommended that rugs be wrapped in plastic for transport and the cleaning company advised that the rug may be infested with bed bugs.

- Wall to wall carpeting can harbour bed bugs and may need to be removed, especially with high infestations, or at least steam treated, paying very close attention to the edges. Previous inspection will help determine where to concentrate steaming efforts. Carpeting may also be treated with a pesticide labelled for use on carpets and rugs.
- The carpet tack strip left behind after wall-to wall carpeting is removed should also be taken up for safety reasons, as well as bed bug management purposes (bed bugs can hide under the strip).



Bed bug eggs and faecal stains along the edge of the carpet.
Photo by R. Cooper

Caulking and Bed Bug Proofing:

- Use clear silicone indoor caulking compound to fill in cracks and crevices along base boards, around light switches and plug plates, window frames and furniture etc.
- Use mesh screening to cover vents in bathrooms and kitchens.

Use of Thermal Heat and Cold Treatments

Thermal Heat Treatment:

Portable heating systems can generate convectional heat in a room to dry out bed bugs. On average, a two to six hour exposure to a temperature of 45oC is a minimal exposure to kill all stages of bed bugs. There is no long-lasting effect with heat treatment and there is a potential risk of scattering bed bugs to adjacent rooms or units unless temperatures of up to 50-55oC can be reached very rapidly. Temperatures above 63oC can damage articles. Caution also needs to be taken to protect certain sprinkler systems, plastics or other items that may be damaged by extreme heat. Some pest management companies wrap infested furniture in plastic and move it to a container off site where the contents are then exposed to thermal heat.

Cold Treatment:

The use of cold temperatures or freezing to kill bed bugs can vary in effectiveness. Placing household items, such as books, in the freezer may kill some bed bugs; however, it has been shown that some bed bugs can recover from being frozen. Items treated in this way must be stored in a freezer for a long period of time, possibly a month, or must be very quickly frozen to an extremely cold temperature to kill all stages of bed bugs. A minimum of -5oC must be held for five days. A freezer capable of providing a flash freezing at -15oC will instantly kill bed bug eggs.

Note: a company that only uses thermal heat or places items into a freezer as a cold treatment (this does not include carbon dioxide freezing – see Use of Pesticides below) is not required to hold an Operator licence or employ a Structural licensed exterminator since these treatments are not considered a pesticide application.

Use of Pesticides

A pesticide product must be both registered under the federal *Pest Control Products Act* (administered by Health Canada's Pest Management Regulatory Agency (PMRA)) and classified by the Ministry of the Environment and Climate Change (MOECC) under the [Pesticides Act](#) and [Ontario Regulation 63/09](#) for legal sale and use in Ontario. **Appendix 3** outlines the process for downloading labels of pesticide products registered in Canada and classified for sale and use in Ontario.

The use of homemade pesticides is illegal for managing bed bugs. Homemade pesticides have not undergone PMRA's evaluation and registration process so there is no way of knowing whether they will work as planned and may pose a risk to people, pets and the indoor environment. Health Canada has a brochure which provides information on the risks associated with using [homemade pesticides](#) available on its website.

Bed bug infestations in apartment buildings, hotels or other multi-dwelling unit facility often require the use of pesticides as part of an IPM program. It is recommended that residents not attempt to use pesticides but contact their building management to report bed bug infestations. Building management should remind residents to follow the IPM program. Pesticides are an important tool in managing bed bugs; however, it is recommended that they should be used by a licensed exterminator who is familiar with bed bug behaviour and uses the appropriate pesticides according to label directions.

Incorrect use of pesticides for bed bugs poses several risks:

- Overexposure to pesticides can cause or aggravate 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.
- Some pesticides can cause bed bugs to scatter resulting in their spread into adjacent rooms.
- Untrained persons often use pesticides in contradiction to label directions or use illegal pesticide products and tend to over apply them.
- Bed bugs can develop resistance to pesticides used against them.

When bed bugs appear in a communal living facility, it is best to hire a pest management professional company and work closely with the Structural licensed exterminator to manage bed bugs safely and effectively. The Structural licensed exterminator should use integrated pest management principles beginning with an education component and a thorough inspection to confirm and locate bed bugs and make recommendations for preparing the room for treatment. Vacuuming, steam treatment/vacuumping and cleaning should be performed, and possibly repeated, before any pesticide treatment.

Only a few types of pesticides are available for use to manage bed bugs. They come in different formulations (liquid, aerosol, dust, foam) but many have the same mode of action as nerve

poisons. Some low-risk products (e.g. diatomaceous earth as silicon dioxide and silica aerogel) result in desiccation and foam formulations can suffocate bed bugs. A pest management professional should be consulted for information about treatment choices. The types of pesticides that are used for the management of bed bugs include:

- Liquid insecticides for spot treatment of mouldings, carpet edges, cracks and crevices etc.
- Aerosol insecticides are available for treating cracks and crevices bed frames, box springs, and under and inside furniture such as dressers but they tend to scatter bed bugs if used improperly.
- Dust formulations are used in cracks and crevices, inside wall voids, behind electrical outlets.
- Foam formulations are used on a multitude of surfaces, wall voids, cracks and crevices.

Responsibilities of Pesticide Users:

- Consider pesticide use only as part of an IPM program.
- Use only federally registered and Ontario classified pesticide products.

Ontario classifies federally registered pesticide products under the Pesticides Act and Ontario

Regulation 63/09 as follows:

- Pesticides used for manufacturing end use pesticide products are in Class 1.
- Commercial pesticide products labeled for the management of bed bugs used with licensed exterminators are in Class 2, 3 and 4.
- Domestic pesticides labeled for the management of bed bug are in Class 5, 6 and 7 and can be used by a Structural licensed exterminator or by a person in his or her premises or by that person's full-time employee to manage bed bugs.

In the case of a tenanted apartment suite or rental unit within the meaning of the *Residential Tenancies Act, 2006*, only the person who occupies the premises can use a Class 5, 6 or 7 product to manage bed bugs without requiring a Structural exterminator licence unless exempt under Ontario Regulation 63/09. An apartment building owner or superintendent (who does not hold a Structural exterminator licence) is only permitted to use a Class 5, 6 or 7 product in common areas or un-rented units unless exempt under Ontario Regulation 63/09.

An exemption is provided in Ontario Regulation 63/09 for the use of a Class 5 or 6 product containing **only** diatomaceous earth labeled for the management of bed bugs. It can be used by any person, including an apartment building owner or superintendent if permission of entry in accordance with the Residential Tenancies Act is provided by the tenant, without need of an Operator licence (i.e. a licence to run a pest management company) or a Structural exterminator licence. However, it is recommended that a Structural licensed exterminator be contracted to use pesticides to manage bed bugs.

Refer to the Ministry of the Environment and Climate Change web site for further information on pesticide;

[classification of pesticides](#)

[pesticides database](#)

- Follow label directions and use a pesticide according to federal pesticide legislation and Ontario's pesticide legislation. **If bed bugs are not specifically listed on the product**

label do not use the pesticide to manage bed bugs. NOTE: Ontario Regulation 63/09 includes exceptions to the cosmetic pesticides ban allowing the use of banned pesticides that are integral to structural exterminations (e.g. inside buildings to manage bed bugs).

- Consider alternative treatments, rather than pesticide use, to mattresses, bedding or other surfaces where people sleep or rest, especially beds of children and cribs of infants.
- Inspect clothing and any other pest management application equipment brought into an infested room that will be taken back to a vehicle or office to ensure bed bugs have not taken refuge.
- A person who is the owner or occupier of the premises, can only purchase and use Domestic[‡] products to manage bed bugs. An exterminator licence is required to purchase and use non-Domestic products.

Carbon Dioxide:

A device that uses liquid carbon dioxide to freeze bed bug adults, nymphs and eggs is now registered as a pesticide in Canada and classified in Ontario for use by a Structural licensed exterminator. This method uses pressurized liquid carbon dioxide through a special “lance” device to create a very thin layer of “snow” to rapidly freeze and kill bed bugs. This leaves no pesticide residual when used according to label directions. Carbon dioxide monitoring equipment and adequate respiratory equipment must be available when using this device in enclosed spaces. Cylinders must be stored properly and transported according to Transport Canada regulations.

What to Look for When Hiring a Pest Management Professional

The following should be considered when hiring a pest management company:

- The pest management company must hold a valid Operator licence issued by the Ontario Ministry of the Environment and Climate Change to run a business that uses pesticides.
- Choose a pest management company that is a member of a professional pest management association. Member companies will have an established place of business, a code of ethics and ongoing training programs. Ask how long they have been in business and how they train staff. Check with better business services to check the record of company business practices.
- The pest management company should have a staff entomologist or access to one or a person who is trained to identify pests such as bed bugs.
- Choose a pest management company based on its quality of service, not the price. Obtain several proposals for service if possible and compare them. Ask what type of insurance coverage the company holds and if the company has had any claims. Request the company provide references of satisfied customers.
- Persons applying pesticides that are employed by the pest management company must hold a Structural exterminator licence or be a Technician or Trainee working under the supervision of the Structural exterminator licence holder. The exterminator must carry his

[‡] Domestic pesticides are registered and distributed primarily to the general public for personal use in or around their homes and are classified for sale and use in Ontario in Classes 5, 6 or 7.

or her licence, issued by the Ministry of the Environment and Climate Change, or have it available at the extermination site.

- The Structural licensed exterminator should have experience with bed bug management. Ask how long he or she has had experience in managing bed bugs.
- A pre-inspection should be conducted to assess the scope of the work.
- The proposed work should follow the principles of IPM.
- The Structural licensed exterminator should be straightforward and open when discussing details of the service being provided. Ask the company to provide in writing how long they estimate the job will take to do properly using an IPM program and if hired note how long the exterminator spends doing the work.
- Understand what guarantees are being offered. Bed bug management may be difficult to guarantee, because re-infestation from an outside source is possible and eggs can hatch several days after being laid if not removed by vacuuming, killed by steam or the hatching nymphs killed by contact with a pesticide.

Proper Disposal of Empty Containers and Unwanted Pesticides:

Empty Domestic pesticide containers can be wrapped in newspaper and disposed of with other household garbage. Empty Commercial pesticide containers should be taken to a pesticide container depot.

Leftover pesticides should never be disposed of in a manner that would harm public health or the environment, such as pouring it down the drain. Waste or unwanted Domestic pesticides should be taken to a designated municipal household waste site. To find the closest waste collection location, contact your municipality or visit the Ministry of the Environment and Climate Change's [Pesticides Disposal web site](#). Be sure to review the list of materials collected at specific sites or call ahead to confirm if pesticide waste is accepted. Commercial pesticides can be disposed using the services of a licensed waste hauler.

Compliance and Enforcement:

If you have questions or suspect unlawful use of pesticides, please contact your local Ministry of the Environment and Climate Change district office during regular business hours. Contact information can be found in the blue pages of your local telephone directory or see a listing of regional and district offices on the [Ministry of the Environment and Climate Change's website](#). After business hours, call the Ministry of the Environment and Climate Change's Pollution Hotline at 1-866-MOE-TIPS (1-866-663-8477).

8) Evaluating the Program

To know whether an IPM program is successful, it is important to lay out what goals are desired and to determine how to monitor the success of the goals over time. Some goals may be long-term and others short-term.

IPM involves planning future goals and evaluating how these goals were achieved by reviewing accomplishments. A successful IPM program determines and records existing pest situations, and then sets up a plan to measure progress to obtain the desired results. Ongoing evaluation is an important component of an IPM program.

For More Information:

Questions about pesticides can be directed to:
Ministry of the Environment and Climate Change Public Information Centre

Tel: 416-325-4000 or toll free: 1-800-565-4923

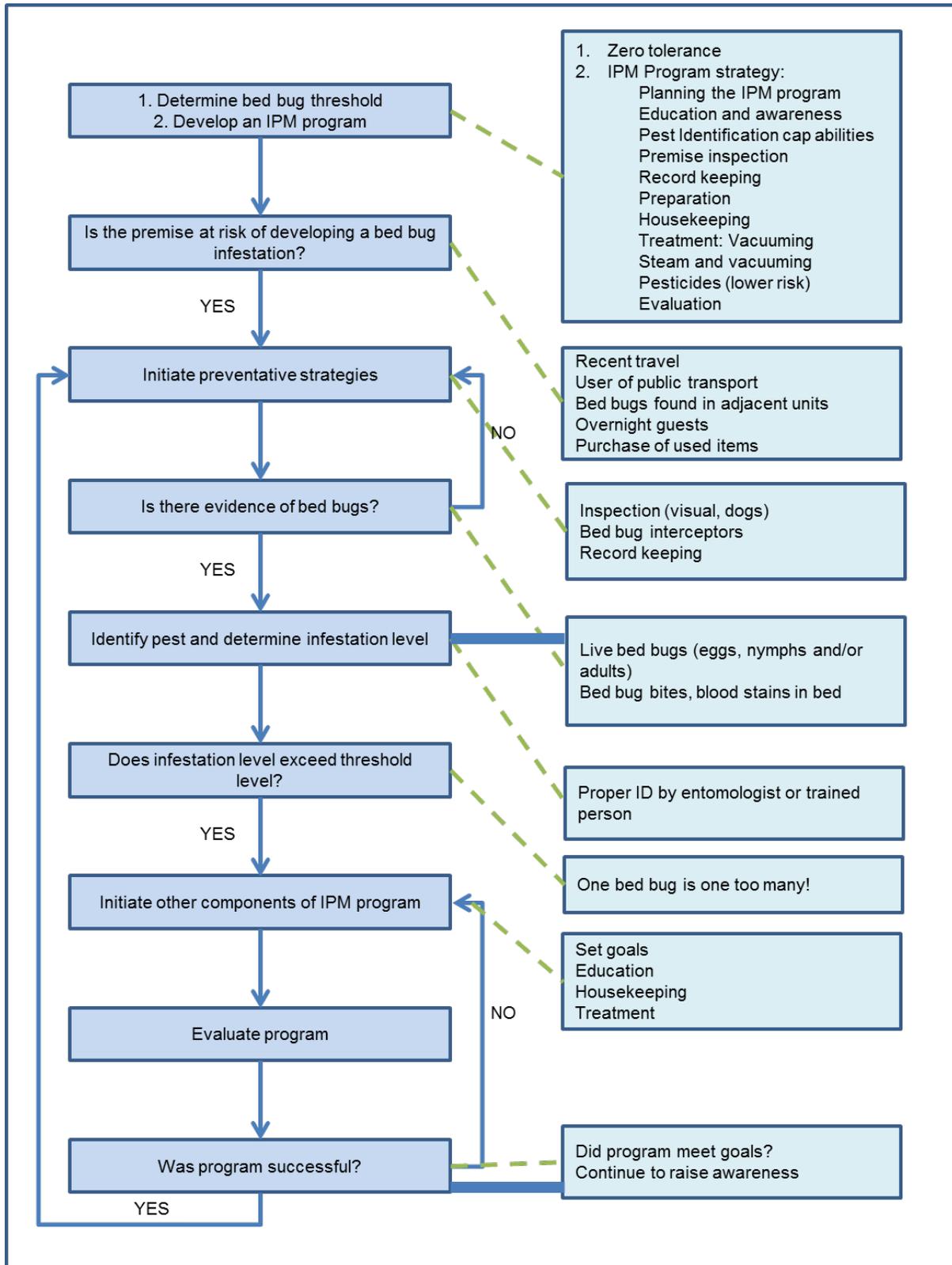
E-mail: picemail.moe@ontario.ca

This document is for informational purposes only and should not be construed as legal advice. Interested parties are advised to refer to the Pesticides Act and Ontario Regulation 63/09 to address specific circumstances with regards to pesticides.

Copyright permission has been granted for the use of information and photographs provided in this IPM program for bed bugs document by Cornell University and the New York State IPM Program.

Appendix 1

IPM Decision Flow Chart for Bed Bugs



Appendix 2

Additional Reading

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Appendix 3

Federal Registration and Ontario Classification

Pesticide product labels that are registered by Health Canada’s Pest Management Regulatory Agency (PMRA) for the management of bed bugs are accessible on the [PMRA label database](#).

Link to the PMRA label search demonstration [web page](#) on how to search for a currently registered pesticide labeled to manage bed bugs. Note: to ensure all products that have bed bugs mentioned on the label use the following search words in the Search Full Contents of E- Labels box:

bed bug or bed bugs or bedbug or bedbugs

The next step is to determine if the registered product labeled for the management of bed bugs is classified for sale and use in Ontario. If the product is registered and classified in Ontario then the product can be used by the appropriate user. Access the Ministry of the Environment and Climate Change [PEPSIS database](#) to determine if the product is classified for use in Ontario Click on the Search button.

Type in the registration number of the pesticide product and click on the SUBMIT button. If the product is classified for sale and use in Ontario it will be shown in the result table under the following headings.

Reg. No	Product Name	Ontario Class	Date of Classification	Federal Classification	Registrant	Active Ingredient Name(s)	Restrictions/Flags	Select Product
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