

A Code of Practice

For the Control of
Bed Bug Infestations
in Australia

2nd Edition (Draft)

June 2007



Stephen L. Doggett



A Code of Practice for the Control of Bed Bug Infestations in Australia

Second Edition (www.bedbug.org.au)
Draft

Stephen L. Doggett*

Department of Medical Entomology,
Institute for Clinical Pathology & Medical Research,
Westmead Hospital, WESTMEAD NSW 2145, Australia.

*On behalf of the Bed Bug Code of Practice Working Party,
Australian Environmental Pest Managers Association,
PO Box 879, BROADWAY NSW 2007, Australia.

First Edition: July 2006. **Second Edition:** July 2007

©2006, 2007. This publication is joint copyright of the Department of Medical Entomology, Institute for Clinical Pathology & Medical Research, Westmead Hospital and the Australian Environmental Pest Managers Association. All images are copyright to the Department of Medical Entomology. No part of this publication may be reproduced in any form or by any means, electronically, mechanically, by photocopying, recording or otherwise, without the prior permission of the copyright owners. However, permission is granted for the reproduction of this document or parts of it, for the purpose of assisting the management of bed bug infestations, on the following conditions: (i) the document is reproduced in its original appearance, (ii) the reproduction is not for the purpose of financial gain, (iii) this Copyright Notice is included in the reproduction. Permission is granted for organisations or individuals to include a link within their own web site to the official web site for this Code of Practice (www.bedbug.org.au).

Warning and Disclaimer

Every effort has been made to make this Code of Practice to be as complete and accurate as possible, but no warranty or fitness is implied. The information provided is on an 'as is' basis. The author or any persons on the Working Party that developed this Code of Practice shall have neither liability nor responsibility to any person, organisation or entity with respect to any loss or damages arising from the information contained in this Code.

ISBN: xxxxxxxxxxxxxxxx

This Code can be freely downloaded from www.bedbug.org.au

TABLE OF CONTENTS

<u>1.</u>	<u>PREFACE TO THE SECOND EDITION</u>	3
<u>2.</u>	<u>INTRODUCTION TO THE FIRST EDITION</u>	4
<u>3.</u>	<u>AIMS</u>	5
<u>4.</u>	<u>DOCUMENT REVIEW</u>	6
<u>5.</u>	<u>DEFINITIONS</u>	7
<u>6.</u>	<u>LIMITATIONS OF THE CoP</u>	8
<u>7.</u>	<u>SCOPE OF THIS CoP</u>	8
<u>8.</u>	<u>REQUIRED PHILOSOPHIES</u>	9
8.1.	<u>Pest Manager</u>	9
8.2.	<u>The Hotelier</u>	10
<u>9.</u>	<u>TRAINING</u>	11
9.1.	<u>Pest Managers</u>	11
9.2.	<u>Accommodation/Housekeeping Staff</u>	11
9.3.	<u>Publications</u>	12
<u>10.</u>	<u>CUSTOMER RELATIONS & EDUCATION</u>	12
10.1.	<u>Pest Managers</u>	12
10.1.1.	<u>Client Confidentiality</u>	12
10.1.2.	<u>Professionalism</u>	12
10.1.3.	<u>Service Contracts</u>	13
10.1.4.	<u>Warranties</u>	13
10.1.5.	<u>Insecticide Usage</u>	13
10.2.	<u>Accommodation Industry</u>	13
10.2.1.	<u>Guest Complaint</u>	13
10.2.2.	<u>Bed Bug Detection</u>	14
<u>11.</u>	<u>OCCUPATIONAL HEALTH AND SAFETY</u>	15
<u>12.</u>	<u>BED BUG CONTROL - AN OVERVIEW</u>	15
<u>13.</u>	<u>PLANNING AND PREPARING FOR INSPECTIONS AND TREATMENTS</u>	15
13.1.	<u>Pest Manager Preparation</u>	15
13.1.1.	<u>Pest Manager Equipment</u>	16
13.2.	<u>Client Preparation & Preparation of Infested Sites</u>	17
<u>14.</u>	<u>INSPECTION PROCEDURES</u>	18
14.1.	<u>Introduction</u>	18
14.2.	<u>Bed Bug Identification</u>	18
14.3.	<u>Bed Bug Indications</u>	18
14.4.	<u>The Inspection</u>	21
14.4.1.	<u>Hotels</u>	21
14.4.2.	<u>Residential</u>	21

<u>14.4.3. The Inspection Process</u>	21
<u>14.5. Bed Bug Sniffer Dogs</u>	23
<u>15. TREATMENT PROCEDURES</u>	23
<u>15.1. Non-Chemical Control</u>	23
<u>15.1.1. Introduction</u>	23
<u>15.1.2. Hygiene</u>	24
<u>15.1.3. Physical Removal</u>	24
<u>15.1.4. Heat</u>	25
<u>15.1.5. Steam</u>	25
<u>15.1.6. Cold</u>	27
<u>15.1.7. Mattress Encasements</u>	28
<u>15.1.8. Vacating a Room</u>	28
<u>15.2. Chemical</u>	29
<u>15.2.1. Insecticide Application & Situational Choices</u>	29
<u>15.2.2. Available Registered Products</u>	30
<u>15.2.3. Insecticide Efficacy</u>	31
<u>15.2.4. Insecticide Resistance Strategies</u>	31
<u>16. POST-TREATMENT PROCEDURES</u>	32
<u>16.1. Client</u>	32
<u>16.2. Pest Manager</u>	32
<u>17. MEASUREMENT OF SUCCESS</u>	32
<u>18. PREVENTION MEASURES</u>	33
<u>18.1. Accommodation Industry</u>	33
<u>18.1.1. Hygiene</u>	33
<u>18.1.2. Linen Handling</u>	33
<u>18.1.3. Guest Linen & Bedding</u>	34
<u>18.1.4. Luggage</u>	34
<u>18.1.5. Inspecting Luggage for Bed Bugs</u>	34
<u>18.1.6. Bed Design</u>	34
<u>18.1.7. Mattress Design & Mattress Covers</u>	35
<u>18.1.8. Room Furnishings & Room Construction</u>	35
<u>18.1.9. Furniture Purchases</u>	36
<u>18.1.10. Ongoing Maintenance</u>	36
<u>18.1.11. Pest Inspections</u>	36
<u>18.1.12. Preventative Insecticide Applications</u>	36
<u>18.1.13. Tracking Infestations</u>	37
<u>18.1.14. Risk Assessment and Management</u>	37
<u>18.2. Multiple Occupancy Residential Complexes</u>	37
<u>18.3. Transport Industry</u>	38
<u>18.4. The Traveller</u>	38
<u>18.5. Second Hand Furniture Retailers</u>	39
<u>19. BED BUGS IN THE DISADVANTAGED</u>	39

20. REFERENCES	42
21. ACKNOWLEDGMENTS	43
22. APPENDIX A – The CoP Working Party	44
23. APPENDIX B – Bed Bug Service Checklist for the Client*	45
24. APPENDIX C – Bed Bug Service Checklist*	46
25. APPENDIX D – Insecticides registered by the APVMA for bed bug control.	53

1. PREFACE TO THE SECOND EDITION

The first edition of the '*Code of Practice for the Control of Bed Bug Infestations in Australia*' (CoP) was produced in response to the re-emergence of bed bugs as a common public health pest. Yet since the birth of the first edition, bed bug numbers have continued to climb. A survey of 121 Pest Managers in 2006 found that across Australia, bed bug infestations had risen by a dramatic 4,500% since 1999, with over 9,000 separately treated infestations (Doggett and Russell, 2007). As this survey was only a fraction of the pest control industry, the increase is undoubtedly much greater, with the true number of treatments perhaps exceeding 100,000. The actual costs associated with bed bugs are also beginning to become realised; one inner city motel with recurrent bed bug problems found that the average cost per infestation came to over \$1,500 (Doggett and Russell, 2007). While it is difficult to extrapolate these costs to calculate the true financial burden on the Australian economy since the resurgence began, a figure of \$100million may well be a very conservative estimate.

Bed bugs are blood sucking insects that can inflict considerable discomfort and cause tremendous mental stress. Additionally, as they are a serious economic burden on the accommodation industry, it is paramount to ensure that the CoP is kept up to date and relevant.

To maintain relevance, the CoP has to evolve in conjunction with the latest issues and research. This edition incorporates such developments including; the use of sniffer dogs for bed bug detection, research in the laundering of bed bug infested linen and recent data on insecticide resistance.

This edition of the CoP also addresses several key issues that have been identified over the last year, including; bed bugs in the socially disadvantaged, infestations in multiple occupancy residential complexes and the need for training of Pest Managers in how to conduct themselves in a bed bug infested

environment to avoid transferring infestations elsewhere.

The CoP is the culmination of the hard work of many individuals and thanks must be given to all who have contributed, especially to the CoP Working Party and those listed in the in acknowledgements.

Bed bugs are currently an international problem and infestations can only be reduced in number worldwide if best practice management options are undertaken globally. It is thus encouraging that the Pest Management Association of New Zealand (PMANZ) and the Confederation of European Pest Associations (CEPA) have adopted the Australian CoP. Other pest management associations can encourage their members to undertake best practice through the promotion of this CoP, and are welcome to do so.

Stephen Doggett
June 2007

2. INTRODUCTION TO THE FIRST EDITION

For some 50 years prior to the end of the 20th century, bed bugs appeared defeated; infestations in the developed world had become so rare that they were no longer considered a serious public health threat. The decline in this once common pest was attributed to improvements in hygiene and the development of powerful residual insecticides such as DDT. Then just before the start of the new millennium, many Pest Managers began to notice an increase in the number of bed bug infestations. This was soon documented in Australia, with one Pest Management company reporting an increase in the number of bed bug treatments by over 1,100% (Doggett 2005). Other Pest Managers anecdotally had also observed a similar trend. The situation in Australia was further exacerbated by the introduction and establishment of the Tropical bed bug, *Cimex hemipterus* (Doggett *et al.* 2003). This species has a preference for warmer climatic zones, whereas the Common bed bug (*Cimex lectularius*), whose existence in the country had long been known, occurs mainly south of Brisbane. The presence of both species meant that the entire continent had become receptive to potential bed bug infestations.

By the early 21st century, bed bug infestations were growing at an alarming exponential level and it has been the accommodation industry that has been the most impacted. The ensuing financial costs associated with bed bugs has been a heavy burden to the Australian accommodation and tourism industry, which has probably lost tens to even hundreds of millions of dollars due to this pest.

The prolonged absence of bed bug activity meant that society was caught unaware. Few Pest Managers had the theoretical knowledge and practical experience to successfully undertake treatments, the Hotelier did not know how to recognise this pest and what to do about an infestation, and finally research into modern control strategies has been nonexistent. Bed bugs are an elusive creature and hide in a multitude of cracks and crevices, and as such, require a tremendous attention to detail to eliminate an infestation. This lack of practical experience in bed bug control has meant infestations have often gone undetected and treatment failures have unfortunately been all too common. The inevitable result is that the number of infestations has continued to increase.

In an effort to stem the rise of bed bugs and to develop a document that could form the basis of industry 'best practice', a Working Party was formed to develop a Code of Practice (CoP) for the control of bed bug infestations in Australia. This Working Party first met in June 2005 at the Melbourne Australian Environmental Pest Management Association (AEPMA) National Conference. The two broad aims were:

1. To develop a CoP that encompasses a holistic approach to the eradication of active bed bug infestations and the management of potential infestations, and,
2. To develop a CoP through broad industry consultation. A draft version of the initial CoP was available for public comment from October 2005 until March 2006. Feedback was requested from Pest Managers, pesticide manufacturers and suppliers, the accommodation industry and tourism bodies, environmental health managers and other health workers, researchers in tertiary institutions, and many other affected stakeholders. The feedback was used to develop the initial release of the CoP. Significant additional feedback has assisted the completion of this revision.

The initial CoP was the first attempt anywhere in the world to develop such a document.

3. AIMS

The aims of the CoP are:

- i. To provide education of stakeholders,
- ii. To define best practice and outcomes,
- iii. To protect stakeholders,
- iv. To provide a reference document on which other more focused documents will be based.

The CoP endeavours to provide a reference document with broad acceptance by the pest management industry, which would be a guide to Pest Managers, the accommodation industry, service industries and professions and the general public on best practice in the control of active bed bug infestations, minimisation of the spread of existing infestations and the prevention of possible future infestations.

The expected outcome from adherence to the CoP would be to minimise the impact of bed bug infestations wherever they occur. If improved control results from the CoP, then this should lead to a reduction in the rate of new infestations.

4. DOCUMENT REVIEW

The CoP will be reviewed periodically to ensure that it incorporates the most recent advances in research and management technology of these pests.

Each edition of the CoP will be valid for a maximum of five years from the date that appears on the front cover. If superseded by a later version, this edition becomes obsolete.

The document review committee will be established by and at the discretion of AEPMA and include at least; one representative of AEPMA, one published scientist who is a recognised expert, one member of a University or Institute of Higher Education (which may or may not be the expert), one representative of an insecticide company and at least three licensed Pest Managers who are recognised as having experience in bed bug control.

Any version encompassing major changes will be made available for public comment. Minor changes will be undertaken at the discretion of the committee. All subsequent changes to the CoP will be documented and made available on request to AEPMA. The Department of Medical Entomology Bed Bug Web Site (www.bedbug.org.au/bedbug_cop.htm) should be checked for the latest version of the CoP.

The CoP is a 'living document' and will be subject to ongoing review. Any suggestions that may improve the CoP can be sent to Stephen Doggett, Department of Medical Entomology, Westmead Hospital, Westmead NSW 2145 or email: stephend@icpmr.wsahs.nsw.gov.au.

5. DEFINITIONS

AEPMA – Australian Environmental Pest Managers Association.

Alginate Bags – Dissolvable laundry bags used for handling infectious bedding.

APVMA – Australian Pesticides and Veterinary Medicines Authority.

Bed bug/s – Either the Common bed bug (*Cimex lectularius*) or the Tropical Bed bug (*Cimex hemipterus*).

Bed Bug Elimination – The inspection and treatment have been undertaken according to the CoP and no living bed bugs were detected in the final inspection.

Bed Bug Friendly – Any item, material (e.g. wood, chipboard, cane, unsealed brick work, etc) or dwelling that contains numerous cracks and crevices, and provides a multitude of bed bug harbourages.

Client – An individual, business or organisation that employs a Pest Manager to undertake a bed bug treatment.

Control – In the context of this CoP, primarily implies the elimination of a bed bug infestation. In some contexts, control also includes bed bug management and prevention.

CoP – Code of Practice, i.e. this document.

Guest – In the context of this CoP, the term is used for any individual staying within any form of accommodation, excluding those privately owned (i.e. homes, units).

Harbourages – Places where bed bugs hide.

Hotel – In the context of this CoP, this is a generic term used for any level of accommodation, excluding those privately owned (i.e. homes, units).

Hotelier – In the context of this CoP, any manager, administrator or owner of short-medium stay accommodation, for example, hotels, motels, guest houses, student lodgings, backpackers, caravans and cabins in caravan parks, B&Bs, landlords, etc., excluding those privately owned (i.e. homes, units).

Housekeeping – Includes staff responsible for hotel maintenance and cleaning.

ICPMR – The Institute for Clinical Pathology and Medical Research at Westmead Hospital, Westmead, NSW.

MSDS – Material Safety Data Sheet.

PestCert – The Australian accreditation body for Pest Managers (see www.pestcert.com.au for more information on PestCert).

Pest Manager – A person licensed to undertake pest management services under relevant State Legislation, and who undertakes a bed bug treatment. Note that this name varies across the country with the different State Legislative Acts.

RTO – Registered Training Organisation under the definition of the Australian Quality Training Framework (see www.dest.gov.au for more information).

6. LIMITATIONS OF THE CoP

Where possible the control and management strategies recommended herein are based on independent and peer reviewed scientific publications. However, due to the paucity of research since the recent bed bug resurgence, particularly in the areas of chemical control and prevention, it has been necessary to initiate this CoP using the successful anecdotal experiences of numerous Pest Managers and researchers. It should be noted that this CoP does not attempt to discuss every technology proposed for the control and management of bed bugs; only those where there is evidence of efficacy through common practice or via publications.

As the bed bug situation is currently highly dynamic, it is envisaged that more insecticides will be registered for control and scientific publications will be forthcoming. Thus it will be necessary to regularly review the CoP.

The CoP does not attempt to provide detailed background information on the biology and ecology of bed bugs. It is recognised that this is essential information and such knowledge will aid in the control and management of bed bug infestations. The biology of the pest will be the guiding principle for management practices. See Section 20 for references to bed bug biology.

9. SCOPE OF THIS CoP

The CoP will include currently identified effective measures, which may be employed against bed bug infestations:

- To control active infestations,
- To minimise the spread of active infestations, and
- To prevent future infestations.

These measures will include:

- Inspection and surveillance practices,
- Monitoring techniques,
- Hygiene practices,
- Management techniques and technologies,
- Environmental manipulation.

In describing measures that may be employed, the following details will be included:

- Risk assessment and management,
- How the measures should be employed for maximum effectiveness and

- safety,
- Circumstances under which the measures should be used,
- Possible integration of measures,
- Limitations of the measures,
- Contra-indications of measures,
- Documentation of measures,
- Required training of Pest Managers,
- Required client education.

The CoP is targeted towards any Australian individual, organisation (both government and non-government), or industry involved with the control and management of bed bugs, those who may be directly impacted by bed bugs, government organisations in the position of enforcing compliancy, or those who are in a position where they could inadvertently spread bed bugs (e.g. second hand furniture sellers, linen contractors). This includes for example; Pest Managers, the accommodation industry & housekeeping staff, campervan hire industry, tourism operators, environmental health officers, charter boat operators, staff accommodation managers, housing organisations, landlords, transport operators, linen contractors, second hand furniture sellers and government.

8. REQUIRED PHILOSOPHIES

8.1. Pest Manager

For bed bug control the Pest Manager must realise that the normal practice of 'management' is not an option, only elimination is acceptable for the client.

The cryptic nature of bed bugs means that complete eradication with a single treatment is unlikely, especially in heavy infestations. The inspection process must be extremely thorough and may take several hours, as all harbourages need to be identified and subsequently treated. Follow up inspections are always required and repeated treatments are usually necessary even in minor infestations. Many insecticides have a flushing effect, which often reveals bugs that did not receive a lethal dose during the initial insecticide treatment. Thus ongoing surveillance during the control program is essential. Inadequate control often leads to a spreading of the infestation with inevitable escalating control costs to the client. By aiming to achieve complete eradication, the risk of insecticide resistance will be reduced.

The Pest Manager should never undertake a bed bug treatment that does not

conform to this CoP as a 'quick fix' solution. For example, the mattress should not be treated on one day and the remainder of the room on the next as this can lead to dispersal of the insect even to adjoining rooms and units. The Pest Manager must attempt to eradicate the infestation with the first treatment. There should be a minimum of one follow up visit (or more with heavy infestations) and the final inspection should determine the success of the treatment.

The Pest Manager should integrate both non-chemical and chemical means of control and aim to minimise the risk of insecticide exposure to the public. Only those insecticides that are either currently registered or approved for use for bed bug control by the Australian Pesticides and Veterinary Medicines Authority (APVMA) must be used by the Pest Manager.

The Pest Manager must provide quality work as per 'best practice' defined in this CoP or warn the client that control will not be achieved. Where the client is unwilling to follow the recommendations of this CoP, the client must accept responsibility for this decision, and this fact must be documented and signed by the client.

Bed bug control can only be achieved if the client fully cooperates with the Pest Manager. Cooperation may include preparing the room for treatment, to possible room closure. If the client is unwilling to cooperate with the Pest Manager, then a warranty may not be issued or better still, the Pest Manager should walk away from the job.

8.2. The Hotelier

The Hotelier should not attempt to control an infestation prior to a site assessment by the Pest Manager. Such attempts can spread the infestation, increase the downtime of the hotel, present a health and safety risk and lead to an increase in control costs.

The Hotelier can not solely rely on the Pest Manager for the prevention of bed bug infestations. It is up to the Hotelier to undertake risk management, educate staff, ensure that appropriate hygiene measures are implemented and maintained, ensure that rooms are not bed bug 'friendly', and implement other strategies to reduce the risk of potential infestations (see Section 18).

The Hotelier must realise that the control of bed bugs is expensive, especially in heavy infestations when rooms may be closed for extended periods. It is not the intention of the CoP to compromise any control activity on the basis of financial impact, no matter how costly. Rather the intention of this CoP is to provide

current 'best practice' for the control of active infestations, the prevention of spreading active infestations and the management of future potential infestations. However, research is encouraged to find the fastest control methods in an effort to minimise disruption and possible cost to the Hotelier and their client/s.

9. TRAINING

9.1. Pest Managers

Pest Managers who undertake a bed bug treatment should be specifically trained in bed bug identification, biology and management. Likewise, the Pest Manager should be trained in how to operate in a bed bug infestation to reduce the risk of acquiring and transporting bed bugs on themselves or their equipment. This includes procedures for how equipment is brought in and taken out of infested sites, how infested beds and furnishings and should be physically handled, how infested items are properly disposed of, and how pest control equipment is stored in the vehicle after leaving an infestation.

Due to the difficulty of bed bug control, under no circumstances should an untrained person undertake a bed bug treatment without the direct supervision of an experienced (as defined by previous sentence) licensed and accredited operator.

This CoP should form the basis of any bed bug training program. Likewise, any bed bug training program being appraised for PestCert compliance must ensure that this CoP forms the basis of the program. All training should be through an RTO or a PestCert appraised lecture or course.

9.2. Accommodation/Housekeeping Staff

Housekeeping staff are in the position where they may recognise the signs of a bed bug infestation before the guests become aware of the problem. While this may not always happen, vigilance can prevent the bed bugs from becoming well established. Housekeeping staff should be trained in recognising the signs of bed bugs, including blood spotting on the sheets, mattresses and walls, and the bed bugs themselves, and routinely inspect the beds for signs of activity. Samples of bed bugs should be kept for future reference and training. Management could record bed bug signs via digital imagery. As housekeeping staff in Australia often do not have English as the first language, staff information should be multi-lingual where appropriate. For the Hotelier, it is important to maintain records of

staff training. Training should be undertaken by an appropriately skilled organisation and include input by a suitably trained Pest Manager. For hotels who use outside cleaning contractors, the Hotelier may consider establishing an in-house executive housekeeping position who would take responsibility for training and documentation.

It is often in the interest of the Pest Manager and their organisation to offer training to accommodation/housekeeping staff as a bed bug aware client can appreciate the difficulties involved in eradication and are more likely to cooperate.

9.3. Publications

All industry publications (be they in pest management, accommodation or housekeeping journals) making recommendations on bed bug control should be in compliance with this CoP.

Industry publications should only be produced by recognised bed bug experts, and/or be externally refereed by a recognised bed bug expert. The referee/s should be included in the acknowledgement to show that the article has been externally reviewed by a recognised expert.

10. CUSTOMER RELATIONS & EDUCATION

10.1. Pest Managers

10.1.1. Client Confidentiality

In the past, bed bugs were largely associated with substandard housing. While this is no longer the case, for many the past association has developed into a stigma by which the client is embarrassed if an infestation occurs. The Hotelier sees bed bugs as potentially impacting on their public image and clientele may be lost if in-house infestations became known. Thus the confidentiality of any bed bug infestation must be assured and must be written into the contract.

10.1.2. Professionalism

As noted above, bed bugs can give a hotel a poor public image. Thus all dealings with Hoteliers must be conducted in a professional manner. An infestation should not be discussed in a location where guests may overhear the conversation, preferably only the management or housekeeping staff should be consulted. Treatments in common areas should be undertaken during times that

would least inconvenience guests.

10.1.3. Service Contracts

The service contract sets out the pest control processes by detailing the work to be undertaken. In the contract, it must be stated that the aim of the treatment is to achieve complete eradication of the infestation. Where possible, a warranty on the service should be provided. Following an initial site assessment, service contracts should include:

- A detailed inspection,
- The treatment,
AND in all cases
- A follow up inspection and treatment (if re-treatment is necessary).

It must be stated that inspection of adjoining rooms (both vertically and horizontally) should be undertaken. The service contract should explain clearly the clients or organisation's responsibilities and include authorised signatures stating when they will carry out any recommendations made by Pest Manager.

10.1.4. Warranties

A client paying for a bed bug treatment expects that elimination will be achieved. Accordingly where practical, the Pest Manager should attempt to offer a written warranty, however, any warranty has to vary with circumstances. These would include the cooperation of the client during treatment as described in this CoP, the quality of ongoing housekeeping, the nature of the room itself (whether or not it is 'bed bug friendly'; refer to Sections 18.1.6, 18.1.7 & 18.1.8), the level of ongoing maintenance (Section 18.1.10) and the potential risk of bed bug reintroduction (e.g. Section 18.2).

10.1.5. Insecticide Usage

It is required by Australian law that all insecticides must be used strictly according to the product label. Consideration should be given to using low odour insecticides. All relevant product label warnings should be discussed with the client prior to any insecticide application. If further information is required then the MSDS or the product manufacturer should be consulted.

10.2. Accommodation Industry

10.2.1. Guest Complaint

There must be clear procedural guidelines followed if a guest lodges a complaint suggestive of bed bug involvement or if housekeeping staff detect bed bugs or

their signs;

- Any report of a possible bed bug infestation must be investigated and be recorded as an incident report. This is the responsibility of the Hotelier.
- Any guest complaining of bed bugs should be immediately moved to another room whenever possible; otherwise if the guest is bitten again, the hotel could be liable. The washing of the guest's clothing in hot water prior to room reallocation may help to reduce the risk of further spreading bed bugs.
- Management should document when the putative infestation was reported, the room number, if and where the bed bugs were observed, and the customer complaint (this may include such things as if bite marks were evident).
- If guests have a severe reaction to the bite, the Hotelier should encourage and assist the guest to seek medical assistance. The Hotelier must never provide any medical advice.
- The hotel management should demonstrate empathy with the guest by explaining that bed bugs are becoming increasingly common throughout the entire industry and that the hotel has strict guidelines in handling an infestation.
- The room should be inspected for bed bugs as soon as possible by appropriately trained staff or a Pest Manager. If the room can not be inspected on the same day, then it should be vacated until an inspection is undertaken. The inspection date and time must be documented, along with the date when the Pest Manager was contacted (ideally the same day), the dates the room was closed, when treatment was undertaken and when the Pest Manager declared the infestation eradicated.

10.2.2. Bed Bug Detection

The following procedures should be implemented upon the detection of a bed bug infestation;

- If the guest has been moved to another room, then the second room should also be inspected and treated once the guest has vacated (again ensuring all above procedures are documented).
- In the event of a positive bed bug infestation, the hotel should provide information to the guest on how to prevent the establishment of bed bugs in their home.
- The Hotelier may wish to contact past guests that had stayed in the room over the previous month to inform of the bed bug infestation and the possibility that the infestation could have been transferred to the home, or other locations.
- The Hotelier should undertake those processes relevant under Section 13 'Planning and preparing for inspections and treatments'.

11. OCCUPATIONAL HEALTH AND SAFETY

All Pest Managers must comply with the relevant State occupational health and safety laws when mixing and applying insecticides. This includes wearing of the appropriate personal protective equipment, and storage and disposal of insecticides. For any insecticide selected for use, the label should be consulted for application rates and application directions, safety instructions, and if there are any use restrictions or requirements (for example, some products can not be applied to mattresses).

If power needs to be disconnected in a room (e.g. switch plates removed for inspection and insecticide application) then housekeeping staff should facilitate any electrically related procedures.

It is likely that in the majority of bed bug jobs that the Pest Manager will need to move beds and other heavy furnishings to gain access to bed bug harbourages. For this reason, it is suggested that housekeeping always assist the Pest Manager in gaining access to harbourage areas in preparation for inspection and treatment.

12. BED BUG CONTROL - AN OVERVIEW

Achieving elimination of a bed bug infestation requires:

- Client co-operation (Section 13),
- A site assessment and a thorough inspection with identification of the pest (Section 14),
- Non chemical and chemical means of pest elimination (Section 15),
- Follow up inspections/re-treatments (Sections 16 & 17),

Risk minimisation procedures will then need to be implemented to reduce possible new infestations (Section 18).

13. PLANNING AND PREPARING FOR INSPECTIONS AND TREATMENTS

13.1. Pest Manager Preparation

The most important preparation that the Pest Manager can undertake is to explain the inspection and treatment processes in detail to the client and to go through the contract. The Pest Manager should provide;

- Information on bed bugs and their biology (a fact sheet should be provided; one can be downloaded from www.bedbug.org.au), and clients should be informed that bed bugs are difficult to control due to their elusive nature.
- Information that states that there is no evidence that bed bugs transmit disease-causing organisms, although some people can develop allergic reactions. If the client has any medical issues, the Pest Manager must suggest that the client consult a General Practitioner. The Pest Manager must never provide medical advice.
- Instructions that it will be necessary to inspect the bedroom, including looking through cupboards and drawers.
- Instructions that it will be necessary to remove bed heads, lift carpets and dismantle other items to access all bed bug harbourages.
- Instructions on any activities the client will be required to undertake prior to the inspection (see below).
- Advice that the client will expect follow up inspections after the initial inspection and treatment.

Following the initial inspection the Pest Manager should advise the client on:

- An outline of the treatment proposal.
- A list of insecticides proposed for use.
- Where the insecticides will be actually applied and any post-treatment recommendation in relation to the insecticides (such as the placement of a mattress cover over treated mattresses).
- A time frame for treatment and an estimate of when the infested area should be closed off prior to re-entry and when it may be re-opened.
- Contract details, including pricing, warranties, and details of any post treatment processes necessary for the client to undertake. The latter should be explained in full with the client and signed by the client.

The Pest Manager should insist that Housekeeping help with the removal of carpets, bed heads, and any other item/s, to protect the Pest Manager from liability claims of excessive damage.

13.1.1. Pest Manager Equipment

The Pest Manager may find the following useful for a bed bug inspection;

- A powerful torch.
- A 10x magnifying lens (to inspect for live bed bugs and eggs).
- Collection bottles (for gathering bed bugs for later confirmation of identity, sticky tape can also be used for gathering bugs).
- Fine tipped forceps (for picking up bed bugs).

- Screwdrivers and spanners for dismantling items.
- An inspection mirror.
- Plastic bags (large and small) to hold bottles, tape, infested items, etc.
- Notepad, for recording details of the infestation.
- Digital camera (for recording infested sites, the digital images or printouts can also be given to the Hotelier in a report or provided as part of an educational package).
- Checklists for a bed bug service (Appendix B & C).

13.2. Client Preparation & Preparation of Infested Sites

The client should not attempt to remove any item from the room before an inspection is undertaken by the Pest Manager, for the following reasons:

- The Pest Manager needs to gauge the true extent of the infestation and,
- Disturbing the infestation may cause the bed bugs to disperse.

In the process of, or immediately following the inspection, all bed linen, curtains and clothing must be removed from the infested areas. It is essential to handle all such items as infectious; they must be bagged before removal from the room and washed in the hottest water possible (>55°C) and/or dried in a hot air clothes drier. Alginate bags are preferable for infested linen, as the bags with the linen enclosed can be placed directly into the washing machine and the bags will dissolve. This reduces extra handling of infested linen and reduces potential cross contamination in laundry facilities. If alginate bags are not available then plastic bags should be used. Delicate items can be placed into a freezer after bagging (see Section 15.1.6). If a linen contractor is used then all potentially infested linen must be kept isolated with instructions to wash separately in hot water.

Likewise, all wardrobes, drawers and cupboards must be emptied and the contents treated as above. After clothing and materials have received the heat treatment, these should not be returned to wardrobes but kept sealed in plastic bags until the infestation is eliminated.

Prior to treatment, the client must be advised to undertake the following:

- All loose articles must be removed from the floor.
- Cover up any fish tanks or preferably remove them from the room to be treated.
- All occupants and pets must vacate the premises and/or area of treatment.
- For infested hotel rooms, the room must be kept closed upon bed bugs being detected until the infestation is declared eradicated.
- If possible the client should provide the Pest Manager with a plan of the building so that the bed bug infestation/s can be recorded where detected.

- To sign and date any bed bug service checklist and return a copy to the Pest Manager.

14. INSPECTION PROCEDURES

14.1. Introduction

The main aim of the inspection process is to detect every possible bed bug harbourage. One of the most common reasons for control failures is the result of inspections that fail to reveal all hiding places. A proper inspection is also necessary to anticipate the time required to undertake control, which is a prerequisite for accurate job costing.

14.2. Bed Bug Identification

Bed bugs are insects that are wingless and dorsoventrally flattened. Adult bed bugs are a reddish brown, 5-6mm when unfed and to almost 10mm when fully blood engorged. The nymphs have a similar body shape to the adults but are translucent and cream in colour, with a size of 1-4mm depending on growth stage (Figures 1-4).

14.3. Bed Bug Indications

Indications of a bed bug infestation include (Figures 1-4);

- Live or dead bed bugs, and cast skins. Live bed bugs will confirm that the infestation is currently active.
- Blood spotting. This is digested blood defaecated by the bed bugs. It may be initially observed on the sheets, but will be commonly noticed along the mattress seams and other places where bed bugs hide. Note that the faeces of nymphal cockroaches appear similar, however bed bug blood spotting tends to occur in groups as the insect by nature is gregarious.
- Eggs (cream in colour with a slight bend, approx. 1mm), which tend to be laid in crevices in dark areas.
- A bed bug smell sometimes described as 'sickly sweet' but is akin to that of stink bugs. This is usually only noticed in heavy infestations or if close to the bugs.

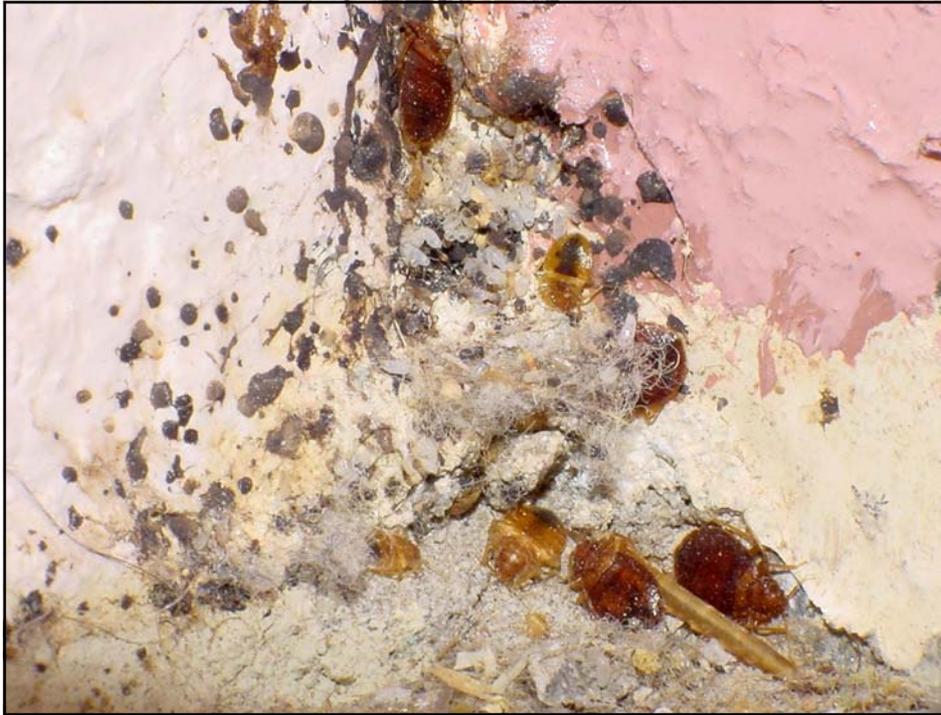


Figure 1. Bed bug adults, nymphs and eggs, along with blood spotting, at a wall/floor junction. ©2005 Department of Medical Entomology, Westmead Hospital, Westmead.



Figure 2. Blood spotting on a mattress, which is typically grouped, indicating the gregarious nature of the insect. No bed bugs can be seen in this image. ©2005 Department of Medical Entomology, Westmead Hospital, Westmead.



Figure 3. A massive bed bug infestation in an ensemble base. It is always necessary to remove the material covering the base in order to treat the infestation. ©2005 Department of Medical Entomology, Westmead Hospital, Westmead.



Figure 4. The 'straight edge' that holds the carpet in place. Numerous eggs and blood spotting are evident. ©2005 Department of Medical Entomology, Westmead Hospital, Westmead. For more bed bug related images see Doggett (2005).

14.4. The Inspection

14.1.1. Hotels

If a treatment is being undertaken in a hotel, then it is important that the housekeeping staff are interviewed to seek information on where guests have complained of bites and where housekeeping staff may have seen bed bugs. Such staff are at the coalface and are more likely to have detailed knowledge about an infestation than the management.

14.4.2. Residential

For treatments in homes, similar questions should be asked to determine areas where residents are being attacked. The Pest Manager should attempt to determine how the bugs were brought into the home; for example if the bugs were brought in via the homeowner, then luggage storage areas need to be inspected and treated. The movements of the person/s affected by bed bugs need to be established; if they have slept in various areas within the home then all of these need to be inspected and probably treated. Areas where dirty clothes and linen are stored should be examined and the homeowner questioned about any previous control attempts.

14.4.3. The Inspection Process

To avoid the risk of transferring bed bugs in equipment a minimum of items should be brought into the infested room. When done so, these should be placed either on a previously inspected chair (with the clients permission and then on a plastic bag to protect the chair) or positioned in an open area away from walls. Equipment should never be placed onto beds, on other furniture or next to walls. Likewise the Pest Manager should avoid prolonged contact with beds, curtains and other potentially infested materials.

Bed bugs have a very flat body shape and can hide in virtually any crack and crevice, preferring dark, isolated and protected areas. Bed bugs prefer wood, paper and fabric surfaces and so these materials should be paid special attention in the inspection process.

The mattress should be the first site inspected, and generally, bed bugs are more likely to be present in the darker areas near the wall. Close attention should be paid to;

- The seams, beading, under buttons, labels, and corner protectors if not previously removed.
- For an ensemble, the base is more likely to harbour the bugs than the top mattress. The edge of the material underneath the ensemble base is a favourite spot for bugs as well as any hollow plastic caster legs. It will

- be necessary to remove the material covering the base of the ensemble.
- For metal framed beds if wooden slats are present; these contain many cracks for bed bugs to hide in and lay their eggs. If the wooden slats are bolted to the bed frame, the bolts should be undone and the drilled holes inspected and treated. Bed bugs can also hide in coils of bed springs and inside hollow bed posts.

The areas around the bed should be investigated next, these include;

- The bed frame, bed head and bedside furniture.
- Bedside furniture, tables, etc, should be turned over and examined.
- The drawers in tables and cupboards should be removed and examined.
- If bed heads are attached to the wall, they should be removed after consulting maintenance staff.
- Other furniture in the room should be inspected, especially locations where luggage is placed, such as luggage racks. For these, close attention should be paid to the seams and buttons (if upholstered) and any wooden join (especially if constructed of chipboard).
- Other inspection sites include appliances such as telephones and audio visual equipment, books, power points and behind switch plates, underneath carpet edges and the straight edge that holds the carpet in place along with rugs, skirting boards, joins in floor boards and under floor boards, loose wall paper and paint, architraves, old nail and screw holes, ornaments, window casings and wall voids.
- Bed bugs may be found higher on the wall in wall hangings, picture frames, wall mirrors, Venetian and vertical blinds, curtains and curtain rods, books, behind electrical conduit, cracks and joins in the ceiling, under ceiling mouldings, smoke detectors and light fittings.

A room site plan should be drawn showing the location of any activity. The room inspection should be as methodical as possible noting all sites of bed bug activity on the site plan.

In any infestation, adjoining rooms and spaces, both either side and above and below, should be inspected.

Bed bugs are often found in lounges in common rooms of hotels and these should be examined. Housekeeping trolleys and laundry areas should also be inspected.

For infestations on vehicles, be they boats, trains, buses, aircraft, etc, similar attention to detail will be required.

14.5. Bed Bug Sniffer Dogs

Bed bug infestations may be detected by the use of sniffer dogs. It is claimed that they can check a room for bed bugs in 1.5 minutes, which is considerably quicker than any human Pest Manager. Sniffer dogs are especially useful for detecting small infestations that are not always obvious and for checking for possible reinfestation when there are signs of a previous infestation, such as blood spotting. As they can readily detect small infestations, sniffer dogs can be employed in a proactive system of bed bug detection. If an infestation is detected early, control is easier and thus treatment success is more likely to be achieved. For the accommodation industry this means there is less chance of guests being bitten by bed bugs (and undertaking possible litigation) and room closure will be reduced. Sniffer dogs can also be used to check the success of the treatment.

Not just any dog can be used as a sniffer dog. Dogs must be trained by an accredited facility [are there accredited facilities in Australia?] and undergo regular retraining. Bed bug 'controls' (i.e. bed bugs placed in ventilated containers, which are then hidden in random rooms) must be used as part of the process of regular assessing the accuracy of detection by the sniffer dog. Currently there are no standard operating procedures in place for bed bug sniffer dogs, however a Code of Practice for termite sniffer dogs is under development, which should have relevance for bed bug detection.

While sniffer dogs have been used successfully for a number of years for termite detection, it should be noted that there have been no formalised independent scientific investigations assessing the worth of bed bug sniffer dogs. For example it is not known if they are sensitive enough to detect one first instar nymph, however such investigations are underway in the USA.

A significant disadvantage of sniffer dogs is that many Hoteliers are concerned that they could pose a possible image problem. The public perception (albeit incorrect) could be that the sniffer dogs are in the facility to detect drugs or even bombs and thus some managers are reluctant to have them used.

15. TREATMENT PROCEDURES

15.1. Non-Chemical Control

15.1.1. Introduction

Non-chemical options should be considered as management tools only. Thus while they can be utilised to reduce the overall bed bug population, complete

elimination of an infestation is unlikely unless insecticides are used as an adjunct.

15.1.2. Hygiene

Reducing the overall biomass of a bed bug infestation can be achieved through discarding infested furnishing. While the Pest Manager can recommend this option, it can be very expensive to the homeowner or Hotelier and not always necessary. The exceptions are mattresses that are torn; these are difficult to treat and should be discarded, unless covered with an appropriate mattress encasement (see Section 15.1.7). Any item to be removed must be sealed in plastic before removal. Such furnishings should be treated before discarding. To avoid others acquiring bed bugs from discarded infested items, the furniture should be destroyed or rendered unusable, for example mattresses and bases should be slashed. They should also be clearly labelled with obvious signs indicating that the items are infested with bed bugs and must be destroyed. In the USA, heat container units are sometimes employed to treat infested furniture, however such devices are yet to become available in Australia.

15.1.3. Physical Removal

Bed bugs should be physically removed via vacuuming or by sticky tape if numbers are small on mattresses. Always use a vacuum machine that has a disposable dust bag. A crevice nozzle can be used along carpet edges adjoining walls, bed frames, mattress seams and in ensemble bases, furniture, and other potential harbourages. Vacuuming cracks and crevices prior to insecticide treatment will not only remove the bugs but dirt as well, which will allow the chemicals to penetrate better and improve their residual effect. After vacuuming is complete, the contents must be sealed within a plastic bag. This should then be destroyed by incineration if possible, rather than just being placed into the general rubbish. If incineration is not possible, then apply insecticide dust to the contents and seal in a plastic bag prior to disposal.

It is important that the vacuum does not become the source for further infestations so it must be properly 'disinfected' following use. Vacuum units that have the base and all hoses composed of solid plastic can be readily sterilised in hot water. This should be done as soon as possible after use. When not in use the vacuum unit itself should be stored in a sealed bag.

The Pest Manager should be aware of the limitations of vacuuming. All previously vacuumed areas need to be treated with insecticides as bed bugs within crevices can hold on against the suction forces. The eggs themselves are glued in place when laid and resist removal via vacuum, meaning that other control measures must be subsequently applied.

Stiff brushes are sometimes suggested for removing bed bug eggs, however it is not recommended as it can disperse the eggs and make control more difficult.

15.1.4. Heat

Bed bugs are very sensitive to heat and are rapidly killed when exposed to temperatures over 45°C. If heat is used for bed bug control it is important that the high temperatures are applied suddenly; a gradual rise in temperature will cause the bed bugs to disperse, thereby potentially spreading an infestation. Thus using heaters to heat up a room to a lethal point for bed bugs is inappropriate.

As noted in Section 13.2, infested linen can be laundered in hot water followed by a hot tumble drying to kill any bed bugs. Studies from the United Kingdom (Naylor & Boase, *pers. comm.*) have shown if the water is at 60°C, then every bed bug stage will be killed in the wash. However, a temperature of 40°C will not be lethal to all the eggs. In Australia, there are State plumbing codes for the temperature of hot water at the outlet. For example, in NSW the requirement for personal hygiene fixtures (such as hand basins, showers and baths) is that the water must be delivered at no more than 43°C in childcare centres, schools or nursing homes, or 50°C for other classes of building. This means that if such water is used to treat infested linen, it may not be hot enough to ensure a complete kill of all stages. Laundries and kitchen sinks do not need to comply with this regulation and the water should be around 60°C (unless mixed with cold water or a long way from the water heater) and will kill all stages. Clearly if hot water is to be relied on for bed bug disinsection, the temperature must be confirmed at or above 60°C.

For tumble drying, the Naylor and Boase investigations found that the dryer had to be operated on the 'hot' setting for 30 minutes to achieve a complete kill of all stages.

It is often promulgated that bed bugs can be killed via heat by placing infested materials into black plastic bags and then into the sun. However, a scientific investigation has shown that this is ineffective with large items such as mattresses, which have a high thermal inertia (Doggett *et al.*, 2006). Since this method can not be relied upon to disinfest items it is not recommended within the CoP.

15.1.5. Steam

The most practical method of exploiting heat is through the use of steam. The great advantage is that it will kill all bed bug stages including the eggs (most

insecticides are non-ovicidal). A study from the United States (Meek 2003) has shown that a program that employs steam followed by insecticides provides better long-term control than by using insecticides alone. As steam is composed only of heated water, some clients favour this treatment over chemicals, particularly for their mattress and bed. However, control can not be achieved with steam alone.

It is important to note that there are many different brands and types of steam machines on the market, however not all are appropriate; the unit must be able to produce steam of a low vapour flow and high temperature. It is best to use commercial units that employ 'dry steam', which allows for quicker drying times. *Note: 'dry steam' is a misnomer; items treated will still be damp and a fan or ventilation should be used to dry the room afterwards, otherwise mould growth can occur.* Steam machines that have a continual flow feature can be filled and remain operational without the downtime of some of the cheaper units, which must go through a reheating phase.

As per all equipment, the steam machine must be properly maintained and the operating temperatures should be regularly checked with the aid of an infrared thermometer. Immediately after steam treatment the surface should be recording a temperature of 70-80°C.

Steam flow rate must be kept to a minimum to avoid blowing bed bugs about (along with exuviae which may contain eggs and nymphs) and to reduce wetting.

Likewise, single jet steam nozzles can blow bed bugs away. If such nozzles are used on mattresses then the nozzle should be always pointed towards the centre of the mattress where propelled bugs can be seen and re-steamed if still alive. Multiple jet steam heads produce a gentler flow rate, are thus less likely to blow bed bugs away and can treat larger areas over a shorter period. In comparison for example, with single jet nozzles it will be necessary to run the nozzle along both sides of edge beading, whereas a single pass with a multiple jet head placed over the beading will usually suffice. Brush heads and brush fittings on steam machines should be avoided as the stiff bristles can fling off eggs and bugs. It is important that the steam be applied directly to the bugs as even a thin layer of cloth may shield the insects.

To reduce the risk of blowing bed bugs about, all areas destined for steam treatment should be vacuumed first.

Like any tool, steam machines are only as effective as the operator. To achieve anywhere near control, an intimate knowledge of the pest and its ecology are essential, inspections must be diligent and the treatment process must be

meticulous. The instructions of the steam machine must be read thoroughly noting all safety instructions prior to use. As all steam machines take time to reach operating temperatures, this can be done while the inspection is in progress.

As the steam machines are operated with a low vapour flow rate it is necessary to place the nozzle *in direct contact* with the surface being treated; the temperature drops away rapidly from the nozzle and a separation of only a few centimetres will not be lethal to the bugs. The nozzle should be moved along at a rate of only 30cm per every 10-15 seconds.

The steam treatment should start with the mattress and be applied to the seams, under labels and handles, and both inside and out of an ensemble base. It will be necessary to remove the material base of the ensemble, which should be kept for the client to reattach after the infestation has been eradicated. Cushions of chairs and sofas should be treated next, paying particular attention to seams and buttons. Always check if the sofa is a sofa bed, and if so, treat the mattress as above. Carpet edges can also be treated with steam, along with the straight edge both above and below. After the completion of the steam treatment, the any dead bugs should be removed via vacuuming, which will help facilitate the determination of treatment success.

As with any technology, steam has its limitations. Being water based, electrocution is a potential issue and thus power points and other electrical fittings should not be steam treated. Steam may damage heat and water sensitive materials, thus the Pest Manager should always test the item to be treated in a non-conspicuous area. Steam will raise the humidity in a room, which can lead to mould growth leading to other potential health issues. Steam treatments are very time consuming. The greatest disadvantage is that steam is non-residual. Thus bugs that are not directly killed (and it is prudent to assume that a certain percentage will not be contacted) will not be exposed to any further control influence unless an insecticide is present. Thus it is always necessary to complete the control process by following up any steam treatment with a residual insecticide.

15.1.6. Cold

The alternative to extreme heat is extreme cold, i.e. freezing the bugs. This has the advantage that heat sensitive materials will not be damaged. While this method can not be directly used by the Pest Manager, it can be recommended to the home owner and Hotelier for small items. Any item for freezing should be placed loosely into a bag, and as always, this must be done in the infested room prior to removal. The amount of time in the freezer would be dependent on the size of the item; the larger the item, the longer in the freezer. If the freezer is

operating at or around -20°C , then two hours at this temperature will kill all stages. However, for the average household freezer, studies indicate that 10 hours will be required (Naylor & Boase, *pers. comm.*). Dense items may take several days for the centre to cool to kill the bugs and the longer an item is kept frozen, the more likely the bugs will be destroyed. Naylor and Boase suggest that 10 hours of freezing is required per 2.5kg of dry weight of laundry.

15.1.7. *Mattress Encasements*

Seamless mattress covers provide fewer potential harbourage areas than mattresses, thus making them less susceptible to an infestation. The covers can also be readily removed for laundering thereby making control easier and being white makes bed bugs and their spotting easier to notice. The benefits provided by mattress covers have been further extended with the recent development of mattress encasements produced by the company 'Protect-A-Bed', (<http://www.residex.com/bedbugs/index.html>), which are now available in Australia. These encasements have incorporated an inbuilt polyurethane coated membrane that is impervious to bed bugs; not only can bed bugs not escape from these encasements, they are unable to bite through the material. In fact, in a study commissioned by the company, some 50 starved adult and 50 first instar nymphal bed bugs were each placed in five mattresses (for a total of 250 adults and 250 nymphs) which were then covered by the encasements. None of the bugs were able to escape, even when lured by human volunteers (Sharpe 2007). This means that an infested mattress and ensemble base can be encased with 'Protect-A-Bed' and in due course all the bugs will die of starvation. A great deal of attention has also been made in reducing seams and places where bed bugs can hide on the encasement. If an infestation ensues, then the encasement can be sterilised via hot wash and dry cycles without affecting the integrity of the membrane.

The obvious advantages of this system are that insecticide use is minimised and cost reduced as the infested mattress does not need to be discarded, even if damaged or heavily infested. As bed bugs can live for up to six months at 22°C , or even longer in cooler climates, this means that the encasement must be kept on the mattress for a long time. Removal prior to this represents an infection risk and there are currently no locking mechanisms to prevent accidental removal.

It is important to note that mattress encasements cannot by themselves stop bed bugs and should be used as part of an overall bed bug management program.

15.1.8. *Vacating a Room*

Leaving an infested room vacant for extended periods is not an option to control

the bugs as they can live for many months without a blood meal. Infested rooms must be treated as per this CoP.

15.2. Chemical

15.2.1. Insecticide Application & Situational Choices

It is a requirement of Australian law that only those insecticides that are either currently registered or permitted for use by the APVMA for the control of bed bugs may be used. The label of the product must be consulted to ensure that it is currently registered.

The insecticide/s to be applied must be directed to all harbourage areas identified in the inspection process, in accordance with label instructions. In most infestations, the carpet and underlay should be peeled back for at least 30cm, and the straight edge treated underneath. Following the completion of treating the infested room, it may be advisable to treat the adjoining rooms even if no bed bugs were seen in the inspection.

The type of formulation selected for the treatment will be dependent on its usage patterns. For example dusts if applied in obvious areas in a hotel will be quickly vacuumed up and rendered ineffective. Dusts can be used in electrical areas while liquid formulations can be utilised in more obvious locations. Dusts can be applied to wall voids if the bugs are suspected of penetrating such areas. They can also be directed to the underneath of carpet edges and under straight edges. Currently there are several brands of dust registered for the control of bed bugs in Australia, although only two different active ingredients occur in the products that are currently available. These include bendiocarb (Ficam), and permethrin (many brands). It should be noted that permethrin is anecdotally considered to be repellent and so bendiocarb dust may be more preferable.

Aerosols insecticides have their use as quick killing agents. Products such as synergised synthetic pyrethroids act very effectively to knockdown and kill the bugs rapidly when applied directly to the insects *in situ* (although it is always best to vacuum first). With extension nozzles, the chemical can be very accurately applied to areas such as beading on mattresses, and cracks and crevices in furniture. For wall hangings and delicate or antique furniture, aerosols may be more appropriate than other formulations, after vacuuming. Aerosols should never be used as space sprays for bed bug elimination; the fine droplets simply will not penetrate into the locations where the insects hide. As most contain pyrethroids, there is an associated excitatory flushing effect and by spraying into a space rather than harbourage areas, the bugs are likely to disperse and can spread an infestation. Like aerosols, the smoke generating insecticides (known as pyrotechnics) or total release insecticides ('bombs') are

also unlikely to penetrate into harbourage areas.

For applying liquid formulations, fan sprays should be used along carpet edges and pin streams for cracks and crevices. Avoid using hollow cone sprays.

It is important to note that not all surfaces can be treated by all insecticides and so the label needs to be carefully consulted. For example, some of the carbamates and organophosphates cannot be used on mattresses. If mattresses are to be treated, there are often specific instructions for this use pattern and it is advisable to recommend to the client that a non-porous cover be placed between the mattress and sheets. Insecticides on a mattress should be kept to a minimum to reduce human exposure and it is preferable to use vacuuming and steam to remove and eliminate bed bugs on beds.

In the past, fumigants were widely used for bed bug control, however as other effective methods exist that pose less operational risk to the Pest Manager and client, fumigants are not recommended within this CoP. Currently, no fumigants are specifically registered for the control of bed bugs. Fumigants also have the disadvantage of not offering any residual protection. The use of ozone as a fumigant is also not recommended within this CoP due to the associated health risks and the fact that the chemical is the main component of photochemical smog.

15.2.2. Available Registered Products

A list of currently registered products is in Appendix D. The main chemicals available to the Pest Manager including their formulations are:

Active Ingredient	Formulation/s	Mode of Action Group*
Bendiocarb	DP, WP	1A
Betacyfluthrin	SC	3A
Cyfluthrin	AC, WP	3A
Deltamethrin	SC	3A
Diazinon	EC	1B
Permethrin	DP, EC, WP	3A
Pirimiphos-Methyl	EC	1B
Various aerosols containing synergised pyrethroids, some with propoxur.	Aerosol	Mostly 3A

AC= Aqueous Concentrate, DP=Dustable Powder, EC= Emulsifiable Concentrate, SC=Suspension Concentrate, WP=Wettable Powder. *see the Insecticide Resistance Action Committee web site www.irac-online.org for details on the various modes of action.

15.2.3. *Insecticide Efficacy*

Recent insecticide efficacy studies and those mentioned in the first edition of the CoP have largely been conducted on susceptible bed bug strains. In light of the recent reports of resistance (see Section 15.2.4), much of the data in these papers may have little current relevance. This paucity of contemporary information is compounded by the lack of any insecticidal efficacy or resistance data for Australia.

It is known that the pyrethroids have an excito-repellency effect with various insects. Many Pest Managers believe that they can repel bed bugs to some degree, and because of this appear to be less effective than the non-repellent insecticides in the field situation. If poorly applied, the pyrethroids can spread an infestation making control more difficult. The carbamates appear not to repel bed bugs and anecdotally appear more effective as a killing agent. Currently the only carbamates registered for bed bugs are bendiocarb and propoxur. The former is available as both dust and wettable powder formulations, and it should be noted that bendiocarb is not registered for use on mattresses. Despite several formulations being registered, propoxur is only readily available in an aerosol.

From the above information and the fact that dusts and wettable powder formulations, such as bendiocarb, leave an obvious deposit, these chemicals should be the insecticides of choice in less obvious locations, while the synthetic pyrethroids or the organophosphates may be used on more open areas. All of these chemicals belong to different insecticide groups (1A, 3A and 1B respectively), which if used concomitantly, may reduce the possibility of further insecticide resistance developing. A synergised pyrethroid aerosol can be used as a knockdown agent and those that contain a residual (such as propoxur) can be applied to cracks and crevices.

At the time of writing the official release date of this CoP, there are no insect growth regulators (IGR'S) which are registered for bed bug control in Australia, and thus their use can not be recommended.

15.2.4. *Insecticide Resistance Strategies*

Overseas investigations from overseas have reported a high degree of insecticide resistance in bed bugs. One study in the USA found that field collected Common bed bugs were several thousand times more resistant to deltamethrin and lambda-cyhalothrin (both synthetic pyrethroids) than susceptible strains (Romero *et al.* 2007). Resistance to both the synthetic pyrethroid alphacypermethrin and the carbamate bendiocarb has been recorded in the Common bed bug in the United Kingdom (Boase *et al.* 2006), while the Tropical bed bug was found resistant to synthetic pyrethroids in Africa (Myamba *et al.* 2002).

From these indications and the anecdotal experiences of Australian Pest Managers, it is reasonable to assume that resistance is occurring here as well. Currently, there are very few insecticides from different chemical groups registered for bed bug control in Australia and thus presently it is not possible to formulate an effective insecticide resistance strategy. The Pest Manager can however assist in reducing the further development of insecticide resistance by integrating non-chemical with chemical means of control and always following the application instructions on the product label when applying insecticides.

16. POST-TREATMENT PROCEDURES

16.1. Client

The client should be advised to undertake the following post treatment:

- Occupants should be encouraged not to re-enter the treated area until after the chemical has completely dried. Refer to label instructions for re-entry period.
- The client should be requested not to vacuum floors and upholstered furniture for at least 10-14 days after final treatment.
- The room should be kept vacant until the Pest Manager declares the area free of bed bugs in a follow up visit. As the eggs take 7-10 days to hatch, this should be the minimum period for any follow up visit. However, in heavy infestations several follow up visits will be required before bed bug elimination is achieved.
- All past signs of the infestation should be removed, such as dead bugs and the blood spotting on walls and mattresses, to avoid future confusion.
- To undertake any preventative measures as outlined below.

16.2. Pest Manager

At least one follow up visit must be made in 7-10 days, with a further chemical application. If the infestation is heavy, further inspection and treatments will be needed.

17. MEASUREMENT OF SUCCESS

A successful treatment is when the infestation identified at the initial inspection has been eliminated.

Treatment success should also be based on assessing the level of client cooperation, along with follow up inspections and treatments. The Pest Manager should ensure that the client has followed all the recommendations prior, during and post treatment. The final inspection should be as detailed as the initial inspection, or even more so. All previously identified locations with bed bugs must be examined, cracks and crevices retreated with a knockdown agent and surrounding areas examined in case bugs have been flushed out by the insecticides. If live bed bugs are observed then a further treatment should be undertaken.

18. PREVENTION MEASURES

For practical reasons it is not always possible to prevent bed bugs from entering a premise. Thus the following section attempts to discuss methods that may minimise the risk of an initial infestation or the growth and expansion of an existing infestation.

18.1. Accommodation Industry

18.1.1. Hygiene

A regular regimen of vacuuming to all areas of a room, especially around skirtings and under lounges and sofas, can reduce the severity of a bed bug infestation, and limit the potential for spreading an infestation. The contents of the vacuum should be sealed and discarded, and the vacuum when not in use should ideally be confined to the one location. For larger establishments, vacuums and cleaning trolleys should be confined to one floor or to a certain section of a floor. Bed bugs can be transferred via cleaning trolleys and isolating the trolleys to an area should help contain this possibility. A minimum of items should be brought into the room, for example cleaning trolleys should be left outside. Any crevices on the cleaning trolleys should be sealed with a caulking agent. Clutter in a room should be kept to a minimum.

18.1.2. Linen Handling

All used sheets and bedding should be sealed in plastic bags within the room before taken outside and placed into linen hoppers. For a known or suspected bed bug infestation, the bedding should be placed into alginate bags. Clean and used linen should be kept separate at all times; they should not be transported to and from rooms via the same trolleys. It may be advisable to colour code linen hoppers to distinguish between clean and used linen. If linen is washed by outside contractors, the dirty and clean linen should not be transported in the

same vehicle.

18.1.3. Guest Linen & Bedding

As the transmission of bed bugs is linked with bedding, guests should not be allowed to use their own sleeping bags and linen. Ideally, sleeping bags should not be allowed in the bedroom but sealed in a plastic bag and placed in a separate storage room. The Hotelier should explain to client the need for this. All linen should be provided by and laundered by the accommodation facility or contractor, which should be in hot water, preferably on a daily basis. For backpacking lodges, rooms should have multi-lingual signs requesting guests to use the linen provided.

18.1.4. Luggage

Isolating luggage such as backpacks and other belongings separately from rooms may help in preventing the transmission of bed bugs but this practice presents obvious logistical problems in terms of storage and security of belongings. If the bags are to be stored elsewhere, this would have to be in metal lockers, which provides fewer harbourages and could be readily treated, otherwise the storage area could aid in the spreading of the bugs. As there is no current information on the benefit of such procedures they are not recommended within this CoP.

18.1.5. Inspecting Luggage for Bed Bugs

Inspecting luggage for bed bugs is probably not appropriate; the eggs are too small to be easily seen and can be laid in any small crack and crevice, and thus would be impractical. Such procedures may also violate privacy laws.

18.1.6. Bed Design

Metal framed beds can limit the impact of bed bugs as they provide little in the way of harbourages and the bed bugs are averse to climbing smooth hard surfaces (unless starved for some time). Thus metal frames can help to contain an infestation; if the bugs fall off the bed, they are unlikely to climb back up and eventually die without a blood meal. Wooden beds offer numerous cracks and crevices for harbourages, and provide many footholds for the insect.

The inherent advantages of metal beds can be rendered ineffective if valances or bed linen are in constant contact with the floor or walls, or if curtains are touching the bed. Such contact will allow access for the bed bugs. Ideally, the metal bed frame should be constructed so that the feet of the legs splay out so that it is impossible to push the bed hard against the wall. To be most effective,

the bed must be made like an island and be isolated.

Other bed designs are not so effective at containing an infestation. Ensemble beds contain many places for bed bugs to hide and lay their eggs. The base of this bed type is especially notorious; the material base cover limits inspection and the areas between the staples are a favoured bed bug haunt. If the caster legs are plastic, they will be hollow and provide further harbourages. The other problem with ensemble bases is that they can be pushed hard against the wall, enabling the bugs to spread via the wall and utilise other locations in the room as harbourages.

In motels the bed head is usually a separate component to that of the mattress and often firmly fixed to the wall. This makes inspection and treatment impossible unless the bed head can be completely removed from the wall (often they are nailed or even glued in place). If power points are attached to the bed head, this can make the inspection more time consuming as power will have to be turned off and electrical fitting disconnected and treated. Where such electrical wires penetrate the wall, this can be an access point by which the infestation can spread to adjoining units. Often the bed heads are made of laminated chipboard, which provides numerous harbourages. Such materials should be avoided in a room to limit bed bug infestations. Ideally in a bed bug unfriendly room, bed heads would not be used.

18.1.7. Mattress Design & Mattress Covers

As bed bugs often hide on the seams of mattress, a seamless mattress, such as the solid rubber foam variety, may be less attractive to bed bugs as fewer harbourages are available. The alternative is to have a seamless mattress cover that can be easily removed for regular washing. If not prohibited to do so, all tags, labels and corner protectors should be removed from the mattress to limit harbourage areas.

18.1.8. Room Furnishings & Room Construction

For the other areas of the room, access for inspection and treatment, and reduction in harbourages should always be the overriding design philosophy for the bed bug unfriendly room. For example, fixed cupboards should be replaced with metal, removable shelves. While these are probably not as aesthetically pleasing, control would be easier as there are fewer places for bed bugs to hide. Many hotels use cane or wicker furniture, especially in seaside and tropical locations. Such furniture is very bed bug friendly, offering numerous harbourages. Likewise, so is open brickwork and sprayed concrete walls. Such walls should be rendered and heavily painted or covered with plasterboard ensuring all joints are well sealed. Carpeted floors provide more harbourages

than solid tiles and carpet squares should be avoided. Solid tiles have the advantage of being easily cleaned via vacuuming or even washed with hot water (or steam). Tiled floors do have associated noise issues for multi-storeyed dwellings.

18.1.9. Furniture Purchases

There are numerous reports of bed bugs being transmitted via second hand furniture. Hotels should not purchase and use any second hand mattresses, furniture or furnishings. Hotels also should limit the practice of transferring furniture from one hotel to another within the same complex or within the same hotel chain. If this becomes necessary, then the items need to be thoroughly inspected for bed bugs.

18.1.10. Ongoing Maintenance

The main aim of ongoing maintenance for preventing bed bugs is the reduction of potential harbourages via sealing any cracks and crevices. Loose wallpaper should be reglued, while paint should not be allowed to deteriorate to the extent that it is flaking from the wall. Decorative plates are often placed over wiring that penetrates into the walls and it is important that a seal such as silicon is placed around the wiring. This is also true for any plumbing pipes.

18.1.11. Pest Inspections

Ongoing pest inspections are essential to reduce the severity of infestations. Ideally this should be undertaken on a routine basis by housekeeping staff when linen is changed and the inspection date recorded, even if no bugs are noticed. The frequency of inspections should be dictated by the number of past infestations and modified according to the rate of new infestations. Sniffer dogs may be used as a sensitive means of detecting early infestations (see Section 14.5)

18.1.12. Preventative Insecticide Applications

The duration of protection afforded by the presently registered insecticides can not be accurately predicted in all circumstances. If insecticides are used without the appropriate intelligence, insecticide resistance can develop. Due to this lack of information and to the fact that relatively few insecticides are available for bed bug control, this CoP does not recommend that insecticides should be currently used in a preventative program.

18.1.13. Tracking Infestations

Hotels belonging to a chain should advise their head office of any infestation and the possibility of new infestations via guests transferring between hotels.

18.1.14. Risk Assessment and Management

Those in the accommodation industry, who are seriously affected by bed bugs, should undertake a risk analysis of past infestations. Rooms afflicted should be analysed to see where the past guests have come from, whether they be from a local region or from overseas. If clear patterns emerge, then the high risk groups should be kept separately from the low risk groups. This may help to contain infestations to certain rooms and to a certain area of a facility.

18.2. Multiple Occupancy Residential Complexes

Like hotels, if bed bugs are detected in one dwelling within a multiple occupancy residential complex (such as apartments, units, flats, townhouses or villas), then the adjoining dwellings should also be inspected. However, it would be unprofessional and a breach of client confidentiality for the Pest Manager to contact the neighbouring premises without the consent (preferably written) of the client. The situation becomes difficult when the adjoining property is the source of the infestation as reinfestation in the treated premise is likely to occur. All the Pest Manager can do in this case is to encourage the occupant to inform the Body Corporate or the Body Strata Manager that bed bugs have been found in the complex and that anyone who experiences bite type reactions should have their premises inspected by a licensed Pest Manager.

In some cases, an occupant's premise within a complex may become infested when an adjoining tenant fails to undertake control of their own bed bug infestation. In these situations, the occupant should inform the Body Corporate or the Body Strata Manager. If the problem remains unresolved it may be necessary to contact an Environmental Health Officer (sometimes known as a 'Health and Building Surveyor') within the local Council, the Public Health Unit and/or State Health Department.

In some states there are strict notification requirements for undertaking insecticidal treatments in common areas and the Pest Manager should check to see if such legislation applies in their respective state (for NSW, see: <http://www.epa.nsw.gov.au/resources/pestmanagement.pdf>). For example, under the NSW requirements, normally the residents must be informed five days prior to the treatment of common areas. However, as bed bugs are biting insects they are exempt from this notification process under the 'Emergency Situation' provision. Despite this exemption, the Pest Manager must still put up notices on

the site when the treatment is undertaken and must keep records to justify carrying out the treatment under the emergency conditions.

18.3. Transport Industry

As bed bugs are transferred from one location to another mainly via luggage, there is a risk that the bugs could be passed from luggage to luggage in cargo holds, luggage trailers, car boots or other areas where luggage is placed or stored. All such sites should be made bed bug 'unfriendly'; cracks and crevices should be kept to a minimum, surfaces should be metal (or tiled for floors) and carpet should be avoided.

18.4. The Traveller

For the traveller who wants to avoid personal infestations or taking bed bugs home, it is important to check their hotel room for evidence of bed bugs. Sheets and mattress protectors should be removed from the bed, and the seams and beading of the mattress checked for the tell tale signs of bed bugs particularly in the darker areas where the bed meets the wall. It is advisable also to check the areas where luggage is placed. If there is evidence of bed bugs then a new room should be requested. If there are signs of blood spotting, even if no live bed bugs are present and the Hotelier states that the room has been treated, it would still be highly advisable to ask for a clean room as it is impossible to know how well the room has been treated and what stage of treatment it is in (such as between the initial treatment and subsequent inspections).

Luggage is the prime means by which bed bugs are transferred from one location to the next and consideration should always be given to means of reducing the risk of bugs infesting the luggage. Prior to inspecting the mattress and bed for signs of bed bugs, luggage should be initially left outside, or in the centre of the room where there are fewer harbourage areas. Belongings should not be unpacked from luggage, and in turn, the luggage itself should be kept in white plastic bags at all times as this may prevent bed bugs from entering the luggage (bed bugs prefer dark areas and so black bags should be avoided). Solid luggage, such as those made of polypropylene or ABS plastic, without external pockets may be more resilient to bed bug invasion than soft bags.

On returning home, luggage should be inspected and kept isolated from the bedroom (such as in a garage). All clothing should be hot washed and/or dried on the hot cycle of a clothes dryer. If there is any possibility an infestation may have been acquired, then a Pest Manager should be consulted.

18.5. Second Hand Furniture Retailers

All mattresses and bed frames should be examined for signs of bed bugs by an appropriately trained inspector before being placed into the store for sale. Infested furniture should be treated as outlined in the CoP.

19. BED BUGS IN THE DISADVANTAGED

A disturbing recent trend is the increasing number of bed bug infestations that are occurring amongst socially disadvantaged groups. These infestations can be massive, involving thousands to even tens of thousands of bugs in a single dwelling. Usually the tenant does not have the economic capability to pay for control or sometimes even the cognitive awareness to know that bed bugs are present, as mental illnesses can be high amongst this group. In multistorey dwellings, these large infestations often only become evident after the adjoining units in turn become infested, which is almost inevitable. Units three stories above or below the prime source can become invaded, while the tenant in the main infestation can pass bed bugs to other units via their clothing or shared items of furniture.

The prime infestation often will have bed bugs virtually everywhere within the dwelling. Not only will the bed be heavily infested, but the bed bugs will be in books, CDs, pictures, wall hangings, clothing, cupboards and other furniture, lounges, whitegoods, under carpets, behind skirtings and in wall cavities. Compounding the challenge of controlling such a large infestation in these homes is that they tend to be heavily cluttered, and bed bugs will be scattered throughout these belongings. Control thus becomes impossible unless the clutter is removed and discarded, or taken off site for fumigation. For the tenant this clutter may be their lifelong belongings and any suggestions of disposal of such property must be undertaken with due sensitivity and in conjunction with the manager of the facility, with the possible assistance of social workers.

The decision to discard or fumigate personal belongings must be undertaken on a case by case basis. Fumigating belongings is a logistical challenge; items must be bagged on site, taken to the fumigation facility, the bags opened, the items fumigated, and post-treatment airing undertaken. All belongings must be taken to a bed bug free storage area and only returned once the initial infestation is eradicated. Thus fumigation must be based on a logistical and financial assessment.

For the Pest Manager these infestations can present an ethical dilemma. On one hand, the infestation is likely to have been present for some time, even years.

This may suggest that the manager of the facility or the carer has not been fulfilling their guardianship role of the tenant with due care. On the other hand, the socially responsible act for the Pest Manager is to inform the relevant State Department of Health (such as the Public Health Unit) or an Environmental Health Officer within the local Council of the nature of the infestation and the need for appropriate action for the welfare of the tenant. However, by informing the responsible organisations, the Pest Manager may feel that they could jeopardise their future employment with the facility. Significantly, this has not been the experience of the authors.

In heavy infestations, the Pest Manager will require considerable cooperation from a number of parties to achieve control. This may include the owner or manager of the facility (such as the state Department of Housing if Government owned, or charitable organisation), contract cleaners, community health nurses, social and/or charitable workers to help relocate the tenant and provide assistance in removing and replacement of clothing and belongings, and maintenance workers to assist the Pest Manager in gaining access to areas for treatment and dismantling fixed items in the premise. It will be necessary that the tenant is relocated and that none of their belongings (including any clothing currently worn) should be permitted into the new premise.

It is advisable that the Pest Manager has a detailed Management Plan, which is provided to all parties. Not only does this appear highly professional but it also protects the Pest Manager in the event that recommended procedures are not undertaken. If an Environmental Health Officer is called in to investigate the infestations, which is not an uncommon occurrence, then a Management Plan may well be requested.

The bed bug Management Plan must include recommendations on:

- The proper handling and disposal of infested items.
- The handling of infested items to be kept for treatment via fumigation.
- Advice on minimising the risk of the tenant passing bed bugs onto any other premise.
- The need to remove carpets, wall paper, floorings, and other fixtures to gain access to harbourage areas for treatment.
- The need to remove skirtings, architraves and other solid fixtures to gain access to harbourages for treatment and wall voids for dusting.
- The treatment process, including non-chemical methods and a list of the actual insecticides employed and how they are used.
- The need for follow up inspections and treatments.
- The necessity to keep the unit unoccupied during the treatment period.
- The need to inspect, and if necessary, treat all adjoining units.
- Recommendations on reducing harbourage locations post treatment, e.g. sealing cracks and crevices.

- Other post treatment processes, such as housekeeping recommendations or other needed refurbishments.

Most importantly, the Management Plan must stress that bed bug eradication is a cooperative venture between the client, the Pest Manager and the other parties.

A behaviour common amongst these tenants is the tendency to collect items off the street that are intended for disposal, such as old furniture. These items may well have been discarded for the very reason of being infested with bed bugs. It thus becomes important for the manager of these facilities to attempt to change such behaviours and limit what can be brought into the dwelling, and this recommendation should be included in the Management Plan. If the tenant is under a carer or regularly visited by friends and family, then these people may have also inadvertently transported bed bugs to their own home. The Management Plan should recommend that the manager attempts to inform all of the tenant's contacts about the bed bug infestation and the possible need of undertaking an inspection in their respective homes.

The Pest Manager should be present when the contract cleaners arrive to discard belongings. The Pest Manager must then inform the cleaners on how the infested belongings are best handled, including any OH&S recommendations (such as the wearing of overalls and the use of gloves), to minimise the risk of spreading the bugs further.

Regarding the control process itself, vacuuming should supplement the discarding of infested items as the preferred form of non-chemical control. As steam is extremely time consuming, in these infestations it becomes impractical to use. This means that insecticides will be the main control tool, preferably using at least two products from different insecticide groups.

Such large infestations represent a high risk to the Pest Manager as control equipment items brought into the dwelling can easily become infested. Likewise, the bugs can get onto clothing and so the Pest Manager should be wary of their procedures, such as inadvertently leaning against objects.

The difficult task with these infestations is establishing when eradication is finally achieved. Only through repeated treatments and follow up inspections, including one at least some months after the initial course of treatments, can the Pest Manager be certain of success. Not surprisingly, such jobs are time consuming, involving numerous consultations, inspections, treatments and follow up visits. Thus the overall price must be commensurate with the labour input and may come to many thousands of dollars.

20. REFERENCES

Those marked with an asterisk contain extensive information on bed bug biology.

Boase C, Small G, Naylor R. 2006. **Interim report of insecticide susceptibility status of UK bedbugs.** *Professional Pest Controller*, Summer: 12-13.

*Cooper RA & Harlan H. 2005. **Ectoparasites, part three: Bed Bugs & Kissing Bugs, Chapter 8.** in Mallis A. *Handbook of Pest Control*. 9th Ed. GIE Media, Pa.

Doggett SL, Geary MJ, Crowe WJ, Wilson P and Russell RC. 2003. **Has the Tropical Bed Bug, *Cimex hemipterus* (Hemiptera: Cimicidae), invaded Australia?** *Environmental Health*, 3: 80-82.

Doggett SL, Geary MJ and Russell RC. 2004. **The resurgence of bed bugs in Australia, with notes on their ecology and control.** *Environmental Health*, 4: 30-38.

*Doggett SL. 2005. **Bed bug ecology and control.** in Doggett SL (ed). 2005. **Pests of Disease and Unease. Synopsis of Papers.** *Westmead Hospital, Westmead*. 69pp. (see www.bedbug.org.au/moreinfo.htm for ordering this publication).

Doggett SL, Geary MJ and Russell RC. 2006. **Encasing mattresses in black plastic will not provide thermal control of bed bugs, *Cimex* spp. (Hemiptera: Cimicidae).** *Journal of Economic Entomology*, 99(5): 2132-2135.

Doggett SL and Russell RC. 2007. **Bed Bugs: Recent Trends and Developments.** *Australian Environmental Pest Managers Association Annual Conference, Synopsis of Papers, Coffs Harbour*. 20pp.

Fletcher MG & Axtell RC. 1993. **Susceptibility of the bed bug, *Cimex lectularius*, to selected insecticides and various treated surfaces.** *Medical and Veterinary Entomology*, 7: 69-72.

Myamba J, Maxwell CA, Asidi A & Curtis CF. 2002. **Pyrethroid resistance in tropical bedbugs, *Cimex hemipterus*, associated with use of treated bednets.** *Medical and Veterinary Entomology*, 16: 448-51.

Meek F. 2003. **Bed bugs bite back.** *Pest Control Technology*, 31: 43,44,46,47,50,52.

Romero A, Potter MF, Potter DA, Haynes KF. 2007. **Insecticide resistance in the bed bug: a factor in the pest's sudden resurgence?** *Journal of Medical Entomology*, 44(2): 175-178.

Sharpe J.W. 2007. **Evaluation of the efficacy of mattress covers and box spring covers for prevention of escape by bed bugs.** *ICR inc. Commissioned report for JAB Distributors LLC*. 71pp.

*Usinger RL. 1966. **Monograph of Cimicidae.** *The Thomas Say Foundation, Maryland*.

21. ACKNOWLEDGMENTS

The ICPMR, AEPMA and members of the Working Party would like to acknowledge the following for their assistance in the production of the Bed Bug Code of Practice Second Edition;

- Mr Frank Meek, Technical Manager, Orkin Pest Control (USA), for providing the service checklist templates used in Appendix B & C, and for his considerable technical input.

Mr Richard Cooper (Cooper's Pest Solutions, USA) and Dr Harold Harlan (Armed Forces Pest Management Board, USA) provided many valuable comments on the first edition of the Code, which were used in the development of this edition.

Mr Richard Naylor (University of Sheffield, UK) and Mr Clive Boase (the Pest Management Consultancy, UK) kindly provided data on the thermal control of the Common bed bug in infested linen.

Dr Paul Byleveld (Manager, Water Unit, NSW Health) generously supplied information from the NSW State Plumbing Code on temperature regulations of heated water within buildings.

22. APPENDIX A – The CoP Working Party.

Name	Position	Affiliation
Stephen Doggett (National Coordinator)	Medical Entomologist/ Senior Hospital Scientist	Dept of Medical Entomology ICPMR, Westmead Hospital (NSW)
Dr Chris Orton	Entomologist – Urban and Commercial Pest Management, Senior Visiting Fellow UNSW	Faculty of Science, University of NSW
Peter and Elaine Arnold	Pest Managers/Directors	Termite Doctors and Pest Management Service (Qld)
Steve Endor	Technical Services Manager	Amalgamated Pest Control
David Gay	Pest Manager/Director	WR Gay and Son (Vic)
Garry Jones	Operations Manager	Eagle Environmental Systems (NSW)
Peter Lamond	Field Biologist	Rentokil Initial (NSW)
Brian Langenberg	Pest Manager/Director	Westate Pest Control (WA)
Justin McBeath	Technical Manager	Bayer Environmental Science
Frank Meek	Technical Director	Orkin Pest Control (USA)
Greg Mills	Pest Manager/Director	Allpest (WA)
Barry Schipplock	National Executive Director	AEPMA

23. APPENDIX B – Bed Bug Service Checklist for the Client*

Note that all rooms adjoining the infested room will need to be inspected and possibly treated.

Customer Responsibilities

- Loosen carpet around the perimeter of the room (s) to be treated. Do not remove carpet from room unless instructed to do so.
- Remove any items that are mounted to the walls i.e. pictures, mirrors, light fixtures, but do not remove from the room as these need treatment.
- Loosen outlet and switch plate covers.
- Remove linens from bed and ensemble base. These should be bagged and hot washed.
- Remove items from closets, treat appropriately for bed bugs and bag.
- Do not remove any items of furniture from the room.
- Provide a building layout plan of the rooms to be treated.

For Commercial facilities

- Make housekeeping carts available for inspection and treatment.
- Make housekeeping rooms available for inspection and treatment.

After Treatment

- Replace all items removed from walls.
- Replace carpet on straight edge or glue back down.
- Re-assemble room for use.
- Keep room unoccupied until infestation is declared eliminated.

Company/Motel Name: _____

Signed: _____ Date: _____

*This checklist was kindly provided by Mr Frank Meek, Technical Manager, Orkin Pest Control, USA, and includes minor modifications.

24. APPENDIX C – Bed Bug Service Checklist*

(Copy to be provided to client once completed)

Motel Name: _____ Contact Name: _____

Contact Phone: _____ Fax: _____

Address: _____

Date Pest Manager Contacted by Company: _____

Date First Inspection: _____ Date First Treatment: _____

Date/s Follow up Treatments: _____

Date infestation eliminated: _____

Period of Warranty: _____

Pest Manager

- Refer to 'A Code of Practice for the Control of Bed Bug infestations in Australia – Second Edition'.
- Respond to calls for bed bug service within 24 hours by phone to schedule the service. Coordinate the service to coincide with preparations by the facility. The Pest Manager must be on site to direct the preparation. If necessary, preparation must be done on several rooms so it is possible to start service after the first room is prepared.

Information to client

- Bed bug service checklist provided.
- Recommended that rooms to be treated taken out of service until the infestation is eliminated.
- Bed bug fact sheets provided, along with details of insecticides.
- Contract and billing details provided, along with schedule of treatment.
- Client advised that adjoining rooms are to be inspected/treated.

Customer responsibilities completed

- ❑ Carpet loosened at floor / wall junction around the perimeter of the rooms.
- ❑ All items attached to the walls removed (e.g. pictures, light fixtures, outlet covers, bed heads, etc.)
- ❑ Outlet and switch plate covers loosened.
- ❑ Linen removed from bed and ensemble base
- ❑ Items removed from closets.
- ❑ Housekeeping carts (if applicable) available for inspection and treatment.
- ❑ Housekeeping rooms (if applicable) available for inspection and treatment.

Pest Manager: _____

Sign: _____ **Date:** _____

Pest Manager Service Procedures

Room nos: _____

Inspection

- Mattress/es (seams, beading, under buttons, labels and corner protectors if not previously removed).
- Ensemble base (material covering base removed, check hollow plastic caster legs).
- Bed frame (wooden slats, bed posts, etc).
- Bed head (if attached, remove from wall).
- Bedside furniture (including removing and checking drawers in tables and cupboards).
- Other furniture (e.g. luggage racks, especially along seams and buttons, wooden joins, especially if constructed of fibreboard).
- Electrical fittings and appliances.
- Underneath carpet edges and the straight edges (plus any other floor coverings, along with joins in floor boards).
- Wallpaper and paint (if loose).
- Architraves, wall hangings, picture frames, wall mirrors, Venetian and vertical blinds, curtains and curtain rods, books, behind electrical conduit, cracks and joins in the ceiling and ceiling mouldings.
- Lounges in common rooms of backpacker lodges.
- Housekeeping carts & rooms, linen & mattress storage rooms, laundry areas.
- Adjoining rooms, above & below.

Inspection Notes

Non-chemical control - Vacuuming

- ❑ Use a vacuum cleaner with a disposable bag.
- ❑ Vacuum floors using crack and crevice tool along the base of the wall.
- ❑ Remove cloth cover from the bottom of the ensemble base. Save for re-attachment after service.
- ❑ Vacuum the seams and general surface area of the mattress and ensemble base. If sofa contains a fold out sofa bed, it must also be vacuumed and removed from the sofa for treatment.
- ❑ Vacuum the seams and general surface area of all cushions from sofa and chairs. Remove cushions from sofas and recliners. Turn sofas and chairs upside down and place in the middle of the room away from the walls.
- ❑ Remove vacuum cleaner bag, dust contents with insecticide, seal and dispose.
- ❑ Inspect folding luggage rack for evidence of insects, if found, treat the infestation.

Non-chemical control - Steam

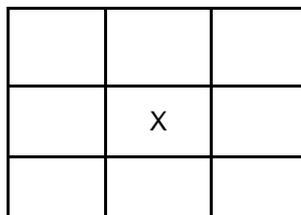
- ❑ Place nozzle directly onto the surface being treated. The nozzle should be moved along at a rate of only 30cm per every 10-15 seconds.
- ❑ Start treatment with the mattress applying steam to the seams, under labels and handles, and both inside and out of an ensemble base.
- ❑ Cushions of chairs and sofas should be treated, paying particular attention to seams and buttons.
- ❑ Check if the sofa is a sofa bed and if so treat the mattress as above.
- ❑ Treat carpet edges along with the straight edge both above and below and curtains.
- ❑ Do not apply steam to electrical fittings.

Chemical control

If steam is unavailable treat those areas described above with insecticide, ensuring that all products are used according the label directions.

- ❑ Apply insecticide to the floor wall junction and under the carpet and straight edge.
- ❑ Apply dust to the inside of all electrical junction boxes. (Light switches, outlets, television cable outlets.)
- ❑ Ensure that the cracks and crevices of the ensemble bases and framework of furniture are treated.
- ❑ Ensure items that will be re-attached to the wall are treated.
- ❑ Inspect guide tracks of closet doors for evidence of bed bugs. If insects are found in this area, have the maintenance staff pull the metal track up and treat. Have maintenance re-attach after treatment.
- ❑ Inspect and treat all rooms where housekeeping carts and extra mattresses or furniture are stored.

Rooms are to be treated in blocks in this general pattern.



X = infested room

All rooms that make contact with the infested room, both above and below, must be treated on the same service.

Notify customer to undertake the following if necessary

- ❑ Repair any loose wallpaper and baseboard covering.
- ❑ Repair any sources of moisture, such as leaky taps and air conditioner condensation lines and pans.
- ❑ After treatment, seal cracks and crevices.

- ❑ Re-attach material covering to ensemble base.
- ❑ Re-attach carpet to straight edge.
- ❑ Place a mattress cover on the mattress according to labelling instructions if treated with insecticides.

*This checklist was based upon a list kindly provided by Mr Frank Meek, Technical Manager, Orkin Pest Control, USA.

25. Appendix D – Pesticides registered by the APVMA for bed bug control as of 27/Jun/2007

Note this is for information only; the APVMA (www.apvma.gov.au) should be consulted for accuracy of information and to obtain a current list of registered products. This list does not distinguish between products available for the home user and the Pest Manager. The 'Approved Use' is as per instructions as described on the label, as appears on the Queensland Department of Primary Industries InfoPest web site. Access to this site was via the link direct from the APVMA site. The product label must be consulted prior to use to confirm the current approved use and for application rates and safety instructions. Note also that just because a product is registered does not necessarily mean that it is still available.

Product Code	Product	Active Ingredient/s	Formulation	States Approv.	Approved Use
31986	FICAM D INSECTICIDE DUST	Bendiocarb	Dust	All	Insect hiding places such as electrical areas, ceilings, wall cavities.
31988	FICAM W INSECTICIDE	Bendiocarb	WP	All	Bed frames, cracks & crevices, not bedding.
32136	BAYGON HOUSEHOLD INSECTICIDE DUST	Propoxur	Dust	All	Bedstead, mattresses, nonporous cover must be placed between mattress & sheets, skirting boards, furniture.
32223	CISLIN RESIDUAL INSECTICIDE	Deltamethrin	SC	All	Bed frames, walls, skirting boards, cracks & crevices.
32254	DEFENDER HOME GARDEN READY FOR USE SPIDER COCKROACH & ANT INSECTICIDE	Permethrin	Liquid	All	Directly at insects, carpets, floor areas, under furniture, wardrobes, and skirtings.
32843	COOPEX RESIDUAL INSECTICIDE	Permethrin	WP	All	Not stated.

Product Code	Product	Active Ingredient/s	Formulation	States Approv.	Approved Use
33210	COOPEX INSECTICIDAL DUSTING POWDER INDUSTRIAL STRENGTH	Permethrin	Dust	All	Bedsteads, bedsprings, mattresses, floor coverings, upholstered furniture, cracks in walls, behind torn wallpaper, joints in woodwork and other cracks and crevices that may provide harbourages.
40102	ACTELIC PUBLIC HEALTH INSECTICIDE	Pirimiphos-Methyl	Liquid	All	Skirting boards, floors and adjacent wall area. Machine wash linen at time of treatment to destroy bed bugs in sheets and blankets.
41698	COUNTRY DIAZINON 800 INSECTICIDE	Diazinon	LC	All	Spray should be applied under beds, along skirting boards and anywhere bed bugs may be able to shelter, as well as lightly to bedding.
41760	CLEVELAND PEST GUARD SURFACE SPRAY AND CRAWLING INSECT KILLER	D-Allethrin, permethrin	Aero	All	Not stated.
45907	CRACKDOWN RESIDUAL INSECTICIDE	Pip but, deltamethrin, D-tetramethrin	SC	All	Cracks & crevices, bed frames.
46237	SOLFAC 50 EW PROFESSIONAL INSECTICIDE	Cyfluthrin	AC	All	Mattresses, clothing (wash before reuse), walls, cracks & crevices, skirting & bed frames.
46433	TONIZONE POW SURFACE SPRAY INSECTICIDE	Allethrin, permethrin	Aero	All	Not stated.
46465	ACTELIC 900SF SOLVENT FREE LIQUID INSECTICIDE	Pirimiphos-methyl	Liquid	All	Apply to run-off point.
46589	TARGET DUST TREATMENT FOR INSECT CONTROL	Permethrin	Dust	All	Bedsteads, mattresses, springs, floor coverings, upholstered furniture, cracks, torn wallpaper, joints in woodwork.

Product Code	Product	Active Ingredient/s	Formulation	States Approv.	Approved Use
46965	HOME BRAND SURFACE SPRAY FOR CRAWLING INSECTS HOUSEHOLD INSECTICIDE	Permethrin, tetramethrin	Aero	All	Not stated.
47105	PEA-BEU SURFACE SPRAY HOUSEHOLD INSECTICIDE INSECT KILLER	Permethrin, tetramethrin	Aero	All	Not stated.
47545	BAYGON SURFACE SPRAY HIGH PERFORMANCE	Propoxur, cyfluthrin, transfluthrin	Aero	All	Not stated.
47546	BAYGON SURFACE SPRAY LOW IRRITANT	Propoxur, cyfluthrin, transfluthrin	Aero	All	Not stated.
48234	COMMERCIAL INSECTICIDE ROACH TOX SURFACE SPRAY	Allethrin, permethrin	Aero	All	Not stated.
48418	MORTEIN PLUS COCKROACH LURE'N'KILL HIGH PERFORMANCE SURFACE SPRAY	Imiprothrin, cypermethrin	Aero	All	Not stated.
48570	OZTEC PERMETHRIN 10 INSECTICIDAL DUSTING POWDER	Permethrin	Dust	All	Not stated.
48607	TUGON 100 WP FLY & LITTER BEETLE INSECTICIDE	Cyfluthrin	WP	All	Mattresses, clothing (wash before reuse), walls, cracks & crevices, skirting & bed frames.
49051	MORTEIN PLUS ODOURLESS LOW IRRITANT SURFACE SPRAY INSECT KILLER	Permethrin, tetramethrin	Aero	All	Not stated.
49084	BARMAC PERMETHRIN D PROFESSIONAL INSECTICIDE DUST	Permethrin	Dust	All	Bedroom furniture, mattresses, cracks & crevices, etc.
50007	BARMAC DIAZINON INSECTICIDE	Diazinon	EC	All	Spray should be applied under beds, along skirting boards and anywhere bed bugs may be able to shelter, as well as lightly to bedding.

Product Code	Product	Active Ingredient/s	Formulation	States Approv.	Approved Use
50347	MICROCARE PRESSURIZED PYRETHRUM CAPSULE SUSPENSION INSECTICIDE	N-Octyl Bicycloheptene Dicarboximide, Pip But, pyrethrins	Aero	All	Not stated.
50682	BLITZ INSECTICIDE	Pip but, deltamethrin, Tetramethrin	SC	NSW	Cracks & crevices, bed frames, adjacent walls.
50918	BAYGON (BAYER) SURFACE SPRAY ODOURLESS WITH NATURAL PYRETHRUM	Pip But, Cyfluthrin, pyrethrin	Aero	All	Lightly spray mattresses, skirting boards and bed frames.
51809	RICHGRO GARDEN PRODUCTS READY TO USE PEST-STOP ANT, SPIDER AND COCKROACH INSECTICIDE	Permethrin	Emulsion	All	Spray insect directly, carpet, floor areas under furniture, in and around cupboards, wardrobes, skirting boards, not clothing.
51915	PIF PAF POWER PLUS CRAWLING INSECT KILLER	Imiprothrin, cypermethrin	Aero	All	Not stated.
51916	PIF PAF ODOURLESS SURFACE SPRAY	Permethrin, tetramethrin	Aero	All	Not stated.
51943	INSECTIGONE INSECTICIDE	Deltamethrin	SC	ex Vic	Not stated.
52198	RESPONSAR BETA SC INSECTICIDE	Betacyfluthrin	SC	All	Mattresses, clothing (wash before reuse), walls, cracks & crevices, skirting & bed frames.
52238	BLATTANEX PROFESSIONAL CRACK & CREVICE AEROSOL	Pip but, propoxur, Tetramethrin	Aero	All	Lightly spray mattresses, skirting boards and bed frames.
52336	DRAGNET DUST - INSECTICIDAL POWDER INDUSTRIAL STRENGTH	Permethrin	Dust	All	Bedsteads, mattresses, springs, floor coverings, upholstered furniture, cracks, torn wallpaper, joints in woodwork.
52365	DELTASHIELD 10 RESIDUAL INSECTICIDE	Deltamethrin	SC	ex Vic	Apply up to run off point.

Draft

Product Code	Product	Active Ingredient/s	Formulation	States Approv.	Approved Use
52913	PERMEDUST INSECTICIDAL DUSTING POWDER INDUSTRIAL STRENGTH	Permethrin	Dust	All	Bedsteads, mattresses, springs, floor coverings, upholstered furniture, cracks, torn wallpaper, joints in woodwork.
53094	CROPRO DIAZINON 800 INSECTICIDE	Diazinon	EC	All	Spray should be applied under beds, along skirting boards and anywhere bed bugs may be able to shelter as well as lightly to bedding.
53210	CREEPY CRAWLEY PRODUCTS DELTA PRO 10 RESIDUAL INSECTICIDE	Deltamethrin	SC	All	Apply up to run off point.
53312	PRECLUDE INSECTICIDE	N-Octyl Bicycloheptene Dicarboximide, Pip But, pyrethrins	Aero	All	Mattresses, bed linen (wash linen and clothing before reuse), walls, cracks & crevices, skirting & bed frames.
53349	COUNTRY DELTAMETHRIN 10 RESIDUAL INSECTICIDE	Deltamethrin	EC	ex Vic	Apply up to run off point.
53522	RELIANCE LOW IRRITANT SURFACE SPRAY	Permethrin, tetramethrin	Aero	All	Not stated.
53534	DAVID GRAYS ANT AND TERMITE SPRAY	Permethrin, hydrocarbon solvent	EC	All	Spray in cracks and crevices and other insect harbourages.
53596	ATLAS CRAWLING INSECT SURFACE SPRAY	Imiprothrin, cypermethrin	Aero	All	Not stated.
53625	FARMOZ PERMEX EC RESIDUAL INSECTICIDE	Permethrin, hydrocarbon solvent	EC	All	Spray in cracks and crevices and other insect harbourages.
53632	DRAGNET HOUSEHOLD READY-TO-USE DUSTING POWDER	Permethrin	Dust	All	Not stated.
53794	DAVID GRAYS PERMETHRIN ANT DUST	Permethrin	Dust	All	Bedsteads, mattresses, springs, floor coverings, upholstered furniture, cracks, torn wallpaper, joints in woodwork.

Product Code	Product	Active Ingredient/s	Formulation	States Approv.	Approved Use
53946	BI-LO LOW IRRITANT SURFACE SPRAY	Permethrin, tetramethrin	Aero	All	Not stated.
53975	RICHGRO PERMETHRIN ANT, SPIDER & ROACH KILLER FOR INDOOR AND OUTDOOR USE	Permethrin, hydro-carbon solvent	EC	All	Spray at insects, carpets, floor areas and furniture. Avoid treated area for several hours. Spray in and around book shelves, cupboards, wardrobes, skirting boards. Do not apply to clothing.
54134	TEMPO RESIDUAL INSECTICIDE	Betacyfluthrin	SC	All	Bed frames, walls, cracks & crevices near beds.
54146	MORTEIN LOW IRRITANT SURFACE SPRAY KILLS COCKROACHES FAST	Permethrin, tetramethrin	Aero	All	Not stated.
54181	CHEMSPRAY HOME PEST CONTROL ANT, SPIDER & COCKROACH KILLER	Permethrin	EC	All	Spray infested carpets, floor areas, in cupboards and wardrobes, and around furniture, bookshelves and skirting boards. Do not apply to clothing or bed linen.
54192	MORTEIN HIGH PERFORMANCE SURFACE SPRAY KILLS COCKROACHES FAST	Imiprothrin, cypermethrin	Aero	All	Not stated.
54224	MITRE 10 READY TO USE ANT, SPIDER & COCKROACH SPRAY	Permethrin	Emulsion	All	Spray insect directly, carpet, floor areas, under furniture, in and around cupboards, wardrobes, skirting boards, not clothing.
54276	CRAWLEY CRUNCHER HOUSEHOLD INSECTICIDE/SURFACE SPRAY	Permethrin	Liquid	All	Not stated.
54456	CISLIN WG RESIDUAL INSECTICIDE	Deltamethrin	Water Dispersible Granule	All	Bed frames, walls, skirting boards, cracks & crevices near beds.
54535	IGA FATAL LOW IRRITANT SURFACE SPRAY	Permethrin, tetramethrin	Aero	All	Apply to bed frame and around sleeping areas.

Product Code	Product	Active Ingredient/s	Formulation	States Approv.	Approved Use
54626	MORTEIN ODOURLESS SURFACE SPRAY KILLS COCKROACHES FAST	Imiprothrin, permethrin	Aero	All	Not stated.
54682	COUNTRY DELTRA RESIDUAL INSECTICIDE	Pip but, deltamethrin, D-tetramethrin	SC	All	Cracks & crevices, bed frames, adjacent walls.
54701	PERMATEK DELTA INSECTICIDE	Deltamethrin	SC	All	Not stated.
54934	YATES ANT, ROACH & SPIDER KILLER	Permethrin, hydrocarbon solvent	EC	All	Spray at insects, carpets, floor areas and furniture. Avoid treated area for several hours. Spray in and around book shelves, cupboards, wardrobes, skirting boards. Do not apply to clothing or bed linen.
55091	COUNTRY PERMETHRIN 25:75 INSECTICIDAL DUSTING POWDER INDUSTRIAL STRENGTH	Permethrin	Dust	All	Bedsteads, mattresses, springs, floor coverings, upholstered furniture, cracks, torn wallpaper, joints in woodwork.
55137	HOVEX PERMETHRIN ANT KILLER	Permethrin	Dust	All	Bedsteads, mattresses, springs, floor coverings, upholstered furniture, cracks, torn wallpaper, joints in woodwork.
55217	MORTEIN EASY REACH SURFACE SPRAY KILLS COCKROACHES FAST	Imiprothrin, cypermethrin	Aero	All	Not stated.
55221	SUPERWAY DELTA-M RESIDUAL INSECTICIDE	Deltamethrin	SC	All	Apply up to run off point.
55329	CHEMRECO TERMINANT ANT, TERMITE AND SPIDER SPRAY	Permethrin, hydrocarbon solvent	EC	All	Spray at insects, carpets, floor areas and furniture. Avoid treated area for several hours. Spray in and around book shelves, cupboards, wardrobes, skirting boards. Do not apply to clothing or bed linen.

Product Code	Product	Active Ingredient/s	Formulation	States Approv.	Approved Use
55416	BAYGON HIGH PERFORMANCE SURFACE SPRAY	Propoxur, cyfluthrin, transfluthrin	Aero	All	Lightly spray mattresses, skirting boards and bed frames.
55420	BAYGON LOW IRRITANT SURFACE SPRAY	Propoxur, cyfluthrin, transfluthrin	Aero	All	Lightly spray mattresses, skirting boards and bed frames.
55421	BAYGON SENSITIVE SURFACE SPRAY ODOURLESS	Pip But, Cyfluthrin, pyrethrin	Aero	All	Not stated.
55426	RICHGRO GARDEN PRODUCTS PERMETHRIN ANT KILLER FOR INDOOR AND OUTDOOR USE	Permethrin	Powder	All	Not stated.
55438	BAYGON HIGH PERFORMANCE SURFACE SPRAY WITH FRESH CLEAN SCENT	Propoxur, cyfluthrin, transfluthrin	Aero	All	Lightly spray mattresses, skirting boards and bed frames.
55656	RENTOKIL CHEK-PEST RESIDUAL INSECTICIDE	Permethrin, hydro-carbon solvent	EC	All	Cracks & crevices, bed frames, adjacent walls, mattresses.
55787	LOW ODOUR GET-IT FLY SPRAY WATER-BASED INSECTICIDE SPRAY READY TO USE	Permethrin	Emulsion	All	Spray insect directly, carpet, floor areas, under furniture, in and around cupboards, wardrobes, skirting boards, not clothing.
55790	LOW ODOUR GET-IT BUG SPRAY HOME AND GARDEN SURFACE AND INSECTICIDE SPRAY READY TO USE	Permethrin	Emulsion	All	Spray insect directly, carpet, floor areas, under furniture, in and around cupboards, wardrobes, skirting boards, not clothing.
55992	K-O TAB WT RESIDUAL INSECTICIDE TABLET	Deltamethrin	Tablet	All	Bed frames and walls, cracks, crevices and skirting boards in the vicinity of the bed. Do not apply to bedding.
56294	TOTAL PEST CONTROL RESIDUAL INSECTICIDE	Deltamethrin	EC	All	Apply up to run off point.
56496	KONK-EM-D READY TO USE INSECTICIDE SPRAY	Permethrin	EC	All	Not stated.

Product Code	Product	Active Ingredient/s	Formulation	States Ap- prov.	Approved Use
56576	BLACK & GOLD LOW IRRITANT SURFACE SPRAY CRAWLING INSECT KILLER	Permethrin, tetramethrin	Aero	All	Not stated.
56578	SIGNATURE RANGE CRAWLING INSECT KILLER SURFACE SPRAY	Allethrin, permethrin	Aero	All	Not stated.
56765	PEST EXTERMINATOR, READY TO USE, COCKROACH, SPIDER & ANT SPRAY	Permethrin	Emulsion	All	Spray insect directly, carpet, floor areas, under furniture, in and around cupboards, wardrobes, skirting boards, not clothing.
56840	FARMOZ PERMEX 100 RESIDUAL INSECTICIDE	Permethrin	EC	All	Apply up to run off, except for mattresses and carpets. Spray in cracks, crevices and other insect harbourages. When applying to mattresses and carpets apply an even thorough coverage.
57006	BRUNNINGS ANT & TERMITE SPIDER, COCKROACH KILLER	Permethrin, hydrocarbon solvent	EC	All	Not stated.
57333	AUSSIECARE NO BUGS BORAFUME FUMIGATOR	Cyphenothrin	Vapour releasing	All	Not stated.
57779	BAYGON ADVANCED HIGH PERFORMANCE SURFACE SPRAY WITH FRESH FRAGRANCE	Imiprothrin, cypermethrin	Aero	All	Lightly spray mattresses, skirting boards and bed frames.
57816	COOPEX EC RESIDUAL INSECTICIDE	Permethrin, hydrocarbon solvent	EC	All	Cracks & crevices, bed frames, adjacent walls, mattresses.
57990	HOME BRAND ODOURLESS SURFACE SPRAY MONEY BACK GUARANTEED SMART CHOICE QUALITY ASSURED LOW PRICE PRODUCT OF AUSTRALIA	Permethrin, tetramethrin	Aero	All	Not stated.
58044	BARMAC DELTA FORCE INSECTICIDE	Deltamethrin	EC	All	Bed frames, walls, cracks & crevices near beds.
58223	PALM GUARD INSECTICIDE	Deltamethrin	SC	All	Not stated.

Product Code	Product	Active Ingredient/s	Formulation	States Approv.	Approved Use
58267	FRANKLINS NO FRILLS SURFACE SPRAY HOUSEHOLD INSECTICIDE FOR CRAWLING INSECTS	Allethrin, permethrin	Aero	All	Not stated.
58423	TRADEWYNS DELTRA RESIDUAL INSECTICIDE	Pip but, deltamethrin, D-tetramethrin	SC	All	Treat cracks and crevices in bed frames and the adjacent walls.
58460	PROLONG FLY AND LITTER BEETLE INSECTICIDE	Cyfluthrin	WP	All	Fumigate all mattresses or clothing. Wash sheets and clothing before re-use. Apply Prolong to walls, cracks and crevices, skirting boards and bed frames.
58499	DELTATHOR PLUS INSECTICIDE	Pip but, deltamethrin, tetramethrin-R	SC	All	Cracks and crevices in bed frames and adjacent walls.
58505	DAVID GRAYS DIAZINON 800 INSECTICIDE	Diazinon	EC	All	Spray should be applied under beds, along skirting boards and anywhere bed bugs may be able to shelter, as well as lightly to bedding.
58600	BAYGON GERMKILL CRAWLING INSECT SPRAY ANTIBACTERIAL	Imiprothrin, cypermethrin	Aero	All	Lightly spray mattresses, bed frames and skirting boards.
58629	BAYGON HIGH PERFORMANCE EGG KILL CRAWLING INSECT SPRAY	Propoxur, cyfluthrin, transluthrin	Aero	All	Lightly spray mattresses, skirting boards and bed frames.
58630	BAYGON FAST KILL CRAWLING INSECT SPRAY	Imiprothrin, cypermethrin	Aero	All	Lightly spray mattresses, skirting boards and bed frames
58632	BAYGON LOW IRRITANT CRAWLING INSECT SPRAY	Propoxur, cyfluthrin, transluthrin	Aero	All	Lightly spray mattresses, skirting boards and bed frames.
58716	MORTEIN HIGH PERFORMANCE COCK-ROACH KILLER	Cypermethrin, Imiprothrin	Aero	All	Not stated.

Draft

Product Code	Product	Active Ingredient/s	Formulation	States Approv.	Approved Use
58717	MORTEIN HIGH PERFORMANCE COCK-ROACH KILLER ODOURLESS	Cypermethrin, Imiprothrin	Aero	All	Not stated.
58723	DELTATHOR INSECTICIDE	Deltamethrin	SC	All	Cracks and crevices in bed frames and adjacent walls.
58783	ATLAS CRAWLING INSECT SURFACE SPRAY FOR HOME USE	Imiprothrin, permethrin	Aero	All	Not stated.
58904	BARMAC DELTA FORCE PLUS INSECTICIDE	Pip but, deltamethrin, D-tetramethrin	SC	All	Cracks and crevices in bed frames and adjacent walls.
59005	PERMETHOR INSECTICIDAL DUST	Permethrin	Dust	All	Bedsteads, bedsprings, mattresses, floor coverings, upholstered furniture, cracks in walls, behind torn wallpaper, joints in woodwork and other harbourages.
59370	COLES HIGH PERFORMANCE SURFACE SPRAY	Cypermethrin, Imiprothrin	Aero	All	Not stated.
59412	YATES INSECT CONTROL BLITZEM ANT, ROACH & SPIDER SPRAY	Permethrin	EC	All	Not stated.
59424	SOLFAC PRO RESIDUAL INSECTICIDE	Betacyfluthrin	SC	All	Apply to the bed-frame and walls, cracks, crevices and skirting boards in the vicinity of the bed.
59707	FARMOZ DIAZOL 800 INSECTICIDE	Diazinon	EC	All	Spray should be applied under beds, along skirting boards and anywhere bed bugs may be able to shelter, as well as lightly to bedding.
59710	ACTELIC 900 SOLVENT FREE LIQUID INSECTICIDE	Pirimiphos-Methyl	Liquid	All	Apply thoroughly to all areas to be treated to run off point. Do not apply to carpets, mats or soft furnishings.

Product Code	Product	Active Ingredient/s	Formulation	States Approv.	Approved Use
59945	GARDEN PRO ANT KILLER	Permethrin	Dust	All	Apply powder to bedsteads, bed springs, mattresses, floor coverings, upholstered furniture, cracks in walls, behind torn wall-paper, joints in woodwork and other harbourages.
60217	WEBTELLIC 900 SOLVENT FREE LIQUID INSECTICIDE	Pirimiphos-Methyl	LC	All	Apply thoroughly to all areas to be treated to run off point. Do not apply to carpets, mats or soft furnishings.
60325	MORTEIN DETTOL WITH GERM STOP COCKROACH KILLER	Cypermethrin, Imiprothrin	Aero	All	Not stated.
60414	HOME BRAND HOUSEHOLD INSECTICIDE	Permethrin, tetramethrin	Aero	All	Spray around bed, bed frame and other locations close to sleeping areas.
60629	MORTEIN DETTOL WITH GERM STOP COCKROACH KILLER HOUSEHOLD PROTECTION	Alkyl Dimethyl Benzyl Ammonium Saccharinate, Cypermethrin, Imiprothrin	Aero	All	Not stated.
60634	SEARLES ANT, SPIDER & COCKROACH KILLER	Permethrin	EC	All	Spray directly when seen. Spray infested carpets, floor areas and under furniture, in and around cupboards, wardrobes, and skirting boards. Do not apply to clothing.
60644	RAID SURFACE SPRAY NATURALLY FRESH	Imiprothrin, cypermethrin	Aero	All	Not stated.
60831	BAYGON ODOURLESS CRAWLING INSECT SURFACE SPRAY	Imiprothrin, cypermethrin	Aero	All	Lightly spray mattresses, bed frames and skirting boards.
61007	HOVEX LOW IRRITANT SURFACE SPRAY	Permethrin, Tetramethrin	Aero	All	Spray around bed, bed frames and other locations close to sleeping areas.
61012	SCARID 10 RESIDUAL INSECTICIDE	Deltamethrin	SC	All	Not stated.

Product Code	Product	Active Ingredient/s	Formulation	States Approv.	Approved Use
61272	SURFACE SPRAY INSECT KILLER	Allethrin, Permethrin	Aero	All	Lightly spray mattresses, bed frames and skirting boards.
61346	KILLS UP TO 6 MONTHS SELECT WOOLWORTHS HIGH PERFORMANCE SURFACE SPRAY	Cypermethrin, Imiprothrin	Aero	All	Lightly spray around bed, bed frames and other locations close to sleeping area.
61349	KILLS FAST! SELECT WOOLWORTHS LOW IRRITANT SURFACE SPRAY	Permethrin, Tetramethrin	Aero	All	Lightly spray around bed, bed frames and other locations close to sleeping area.
61431	HOVEX HIGH PERFORMANCE ANT KILLER EFFECTIVE PROTECTION AGAINST ANTS	Cypermethrin, Imiprothrin	Aero	All	Not stated.
61432	HOVEX HIGH PERFORMANCE SPIDER KILLER EFFECTIVE PROTECTION AGAINST SPIDERS	Cypermethrin, Imiprothrin	Aero	All	Not stated.
61437	HOVEX HIGH PERFORMANCE COCKROACH KILLER EFFECTIVE PROTECTION AGAINST COCKROACHES	Cypermethrin, Imiprothrin	Aero	All	Not stated.



Approved for use upon mattresses

AC = Aqueous Concentrate

LC = Liquid Concentrate

Aero = Aerosol

SC = Suspension concentrate

EC = Emulsifiable Concentrate

WP = Wettable Powder