



The Delta Five Automated Insect Monitoring System discreetly attaches to a wall or surface behind the bed.

GREEN, DIGITAL TECHNOLOGIES

Revolutionize the Way PMPs Perform Bed Bug Work in Hotels and Beyond



Executive Summary

Digital pest monitoring technology like Delta Five's IoT sensors and traps significantly contribute to the control of bed bugs and others pests in hotel rooms by facilitating early detection and early intervention, thus reducing or eliminating the need for insecticide treatment.

— Jason A. Janét, Ph.D., CEO, Delta Five, LLC

"This system completely changed our approach and how we think about pest management. Working together with our pest management partner, our programs are much more effective and provide the highest level of confidence that our guests will not encounter any type of pest during their stay."

— Michael Heeden, President, Winston Hospitality, Inc.

What Exactly Is the Delta Five Telemetered Perpetual Monitoring System (TPMS)

The Delta Five Telemetered Perpetual Monitoring System (TPMS) stands at just three inches tall and sits discreetly between the headboard wall and bed. This powerful system uses an imperceptible lure to attract pests, and internal computer vision and WiFi to identify pests that enter. The camera located inside the device is triggered by the presence of an insect. Then an image of the pest is immediately sent to operators for further action. These Automated Insect Monitoring Devices are the proverbial looking glass for Pest Management Professionals to know what is happening at account sites, even when they are not present.

The Problem with the Traditional Approach to Controlling Bed Bugs

Conventional pest management practices rely on labor-intensive, manual inspections and chemical-based treatments to address infestations of bed bugs and other insect pests. This poses many problems for pest professionals and hotels alike because hotel guests are often the first to discover bed bugs. Guest-pest encounters can have multiple consequences. They may put the hotel's reputation at risk, result in expensive guest compensations, escalate hotel staff stress levels, and take revenue-producing rooms out of service.

This conventional complaint-based approach has several drawbacks for the pest professional, as well. When a bed bug problem is suspected the pest professional must promptly mobilize and support their client. This can result in avoidable operational costs that are, subsequently, billed back to the client. Purported alter-

“The Delta Five System allows users to detect bed bugs remotely and continuously, and then use the rich stream of data provided from many devices to tailor decisions. A bed bug detection is backed up with definitive photographic evidence.”

— *Kenneth Haynes, Ph.D., Professor, Department of Entomology, University of Kentucky*



3"



bed bug incident

- Significant savings on reduced pesticide use
- Helping pest professionals meet the demand for green, eco-friendly service offerings
- Instill confidence in both PMPs and hoteliers that rooms are bed bug free

The Use of Delta Five in Controlling Bed Bugs and Other Insects

Delta Five maintains historical data on a fleet of approximately 10,000 globally-distributed TPMS devices, and shows that 94% of bed bugs are detected without guest-pest encounters. This is 2X-3X better than results from conventional PMP inspection practices (human and canine inspections). From the same data, 88% of bed bug captures were determined to be the only discoverable bug in the room, proving early detection.

Delta Five’s TPMS are proving equally capable of detecting (and identifying) other types of insects before they are detected by guests, residents and PMP technicians. Other studies found:

- **Silverfish:** 18-month, 505-Room, 2-hotel study showed that TPMS detected all 66 silverfish before guests, hotel staff and PMP personnel [Ecolab] detected them. No other silverfish were discovered by the PMP. Additionally, the digital systems enabled the hotels to locate emerging moisture problems that would not have otherwise been detected.
- **Cockroaches, Ants and Spiders:** 21-month, 508-room, 6-property study

The Delta Five Automated Pest Monitoring System provides real-time photo alerts.

natives, such as canine-based inspections, have been shown to yield low early-stage detection accuracies, and result in delayed detections, which enable infestations to become established. Similarly, passive monitors, which are unappealing in hotel environments, require manual labor to locate, inspect, clean and replace. In addition, “preventative insecticide” applications may actually add to the growing problem of bed bug resistance.

The efficacy of spray formulation insecticide is becoming increasingly limited, according to Dr. Dini Miller Professor of Entomology, Department of Entomology, Virginia Tech, due to bed bugs possessing at least three different types of insecticide resistance (mutation at the target site of the nerve where the pesticide is supposed to work; enhanced detoxification enzyme activity and reduced cuticular penetration). Furthermore, not only might these chemical-based treatments be ineffective, they are also becoming increasingly less desirable from a customer’s perspective.

Why Digital Systems Are Needed For Early Detection of Bed Bugs

“One reason I think the Delta Five monitor is the way of the future is that we need

something to alert us that bed bugs are present. The phone notification will allow us to take the next step, which is inspection and/or treatment,” said Dr. Miller. Digital Systems, such as Delta Five’s IoT sensors and traps, offer a revolutionary change in the way pest management professionals approach bed bugs and other pests in hotel rooms. Benefits for pest management firms include:

- Reduced labor expense by eliminating the need for visual inspections in non-alerted rooms
- Time savings because the technician can arrive at the account with a targeted treatment plan for rooms that have had a

Benefits of the Delta Five System

The eco-friendly Delta Five Automated Pest Monitoring System offers a number of advantages to PMPs serving commercial accounts including:

- Eliminates the need for insecticides that target bed bugs, ants, cockroaches, spiders and other common invaders in the vast majority of hotels and commercial buildings.
- Revolutionizes pest management in hotels and beyond by detecting bed bugs and other pests at the introduction stage, thereby enabling pest management professionals to address them before full-fledged infestations set in.
- Detects bed bugs early to make treatment protocols more efficient and timely, reducing the need to take rooms out of service for treatment and, as studies have shown, eliminate the need for highly intensive treatments.

showed that ants, spiders and cockroaches comprised 6% of the total pests captured, despite all of these rooms receiving “preventative” insecticide treatments that specifically target these species.

Paradigm Shift: Chemical-Free vs. Insecticide-Based

Research shows that “low-level bed bug infested one-bedroom apartments (<12 bed bugs based on interceptor count and visual inspection) were eliminated rapidly with non-chemical methods alone.” In the case studies that follow, it is similarly hypothesized that digital systems, like the Delta Five TPMS, significantly reduce — and possibly eliminate — the need for insecticides in the vast majority of hotel rooms, including specifically:

1. Preventative insecticides that target ants, cockroaches and spiders do not actually eliminate these insects in hotel rooms, and are not needed above the ground floor.
2. Preventative insecticides that target bed bugs do not actually reduce bed bug activity in hotel rooms.
3. Elimination insecticides that target bed bugs are not needed in the majority of hotel rooms that use digital systems, like the Delta Five TPMS due to the aforementioned early detection performance.

The dependent variable is, simply, pest activity, which measures the number of rooms where pests are detected. New pest activity measures the number of times pests are discovered in hotel rooms with no prior history of pests. Post-elimination pest activity measures the number of times pests are discovered in hotel rooms that were previously treated to eradicate existing pests. Activity is observed by: 1) validated TPMS alerts; 2) validated guest-pest encounters; 3) hotel staff findings; and 4) PMP inspections.

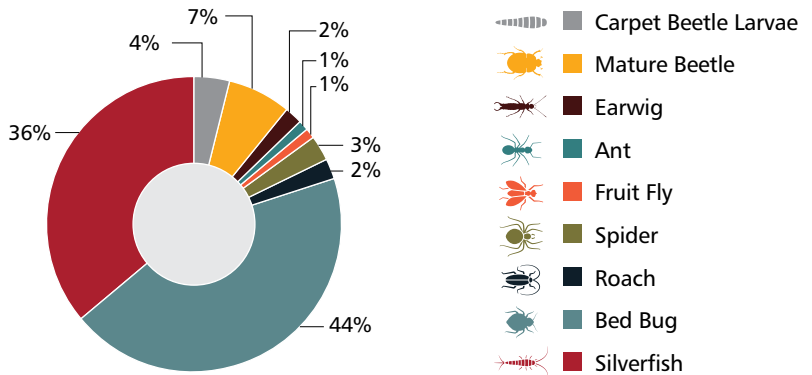
The independent variable is the use or absence of insecticides for prevention and/or elimination.

The control in these studies is 18 months of historical data for 395 hotel rooms that received insecticide-based ant/cockroach/spider prevention treatments, and also received insecticide-based elimination treatments. During this time, the following observations were made:

- a. Bed bug Activity Average: 4.11 bed bugs per month.
- b. Sole Bed Bug Capture: 88% of bed bug captures correlated to being the only bug found

- c. Pest Distribution: The pest distribution in this particular study is shown in the pie chart below.

DETECTED PEST CLASSIFICATIONS



CASE STUDIES

CASE 1: Insecticide-based Elimination of Cockroaches, Ants & Spiders

A sample set of 506 hotel rooms in five hotels was monitored, where all of the rooms received preventative treatments by licensed PMPs (four from top-5 nationally ranked organizations, and another from a top-100 ranked organization) over 12 months, using industry-standard protocols.

Shown in the pie chart above, 2.4% of rooms experienced cockroach, ant and spider activity. Additionally, 1.7% of rooms showed activity from silverfish, earwigs, fruit flies, beetles and carpet beetle larvae. It is also worth noting that 1.5% of rooms had bed bug activity.

We conclude from this set of field studies that PMP-standard insecticide applications do not prevent cockroaches, ants and spiders in hotel rooms.

CASE 2: Insecticide-based Bed Bug Prevention

Shown in the table below, for 120 days after application of an industry standard insecticide that targets bed bugs and claims residual performance for 30-180 days, bed bug activity did not decrease. Rather surprisingly, observed bed bug activity actually increased. Specifically, the average monthly bed bug activity increased from 4.11 bed bugs per-month to 7.75 bed bugs per-month relative to 18-month historical performance (a 92% increase). Bed bug activity increased from 4 bed bugs per-month to 7.75 bed bugs per-month relative to a prior-year 3-month historical performance (a 95% increase). Bed bug activity increased

FIELD RESULTS (CASE STUDY #2)

HOTEL	Pre-Insecticide 18-month Average Monthly Bed Bug Activity	Pre-Insecticide Prior-Yr, 4-month Average Monthly Bed Bug Activity	Post-Insecticide Current-Yr, 4-month Average Monthly Bed Bug Activity
Monthly Bed Bug Activity	4.11 Bed Bugs per month	4.00 Bed Bugs per month	7.75 Bed Bugs per month
% Rooms with Bed Bugs	1.04% Rooms	1.01% Rooms	1.96% Rooms

from 4 bed bugs per-month to 9.67 bed bugs per-month relative to a prior-year 3-month historical performance (a 141% increase).

We conclude from this field study that PMP-standard insecticide-based prevention does not prevent or reduce bed bug activity in hotel rooms. Additionally, it is worth noting that, while this insecticide is not sold as a repellent, it seems possible that it is functioning as such; certainly the insecticide is not *increasing* bed bug populations in rooms. Thus, the uptick in bed bug activity may be attributed, in part, to the reduction in potential bed bug harborages and/or passageways (floor, baseboard or wall-facing headboard surfaces). Assuming this insecticide successfully kills bed bugs that contact it, and given that TPMS-based bed bug activity is detected at or on the bed, this data also suggests that many, if not most, bed bugs are directly introduced to a hotel room bed (circumventing the insecticide-coated floor-baseboard regions).

CASE 3: Insecticide-based Elimination of Bed Bugs

The sample set of 395 rooms from Case 2 was also monitored for the number of times insecticide-based elimination efforts, carried out by the same top-100 ranked PMP, resulted in recurring bed bug activity within a 30-day, post-elimination window. Over the same 18-month time-frame, exactly 10 insecticide-based elimination efforts resulted in recurring bed bug activity within a 30-day, post-elimination window. Additionally, another bed bug insecticide-based elimination event, which was conducted by licensed and reputable independent-party PMPs, showed recurrence of bed bug activity within 65 days.

We conclude from this field study that insecticide-based elimination efforts do not categorically eliminate bed bugs. This conclusion is likely not as surprising because PMPs have often acknowledged multiple callbacks subsequent to elimination efforts. Unfortunately, callbacks impact hoteliers and property owners by taking revenue-producing spaces out of service.

CASE 4: Insecticide-Free, TPMS-based Prevention and Elimination of Bed Bugs

In light of the aforementioned research, the 94% prevention of guest-pest encounters, and the 88% lone-bed bug findings, two TPMS-fitted hotels monitored a combined total of 239 rooms for bed bug activity where the rooms solely used Delta Five digital monitors and traps. That is, no insecticides were used for prevention or elimination.


Shown in the table below, over the span of three months, the insecticide-free, TPMS-only rooms showed: 1) no increased bed bug activity; and, 2) no recurring bed bug activity. Additionally, no bed bugs were found outside of the traps during post-capture visual inspections.

To clarify, six bed bugs were captured by TPMS during the on-going evaluation period. When normalized for the number of rooms, the average monthly bed bug activity is 0.84% of insecticide-free, TPMS-only rooms, and 0% of these rooms had recurring bed bug activity after TPMS capture. The latter point is actually 12% better than the average 88% TPMS-room performance, and reinforces the hypothesis that the TPMS digital system captures bed bugs during introduction stages.

We conclude from this on-going field study that insecticide-free, TPMS-only prevention is effective in hotel rooms. We further conclude that, post-detection TPMS-only elimination is effective in hotel rooms. For hoteliers, this yields myriad benefits that reflect positively on the PMP that services them. These include, but are not limited to:

- Substantially reducing pesticide applications from the room environment
- Preventing guest compensations, complaints, litigation and medical claims
- Substantially eliminating the costs of post-detection inspections in primary and adjacent rooms
- Substantially eliminating lost revenue from guest room down-time
- Substantially eliminating negative reviews, litigation and/or medical claims

FIELD RESULTS: CASE STUDY #4

	Avg Monthly Bed Bug Activity	Avg Recurring Bed Bug Activity	Calculated Savings to Hotelier
Baseline: Delta Five TPMS + Std PMP Insecticide	1.04%	13.5%	\$1,178/ Bed bug
Non-Insecticide: Delta Five TPMS-only	0.84%	0%	\$1,743/ Bed bug

Concluding Remarks:

By placing Delta Five into a room, monitoring and promptly reacting to an alert of a bed bug, pest management professionals are able to promptly address pest introductions and eliminate the need for time-consuming, expensive treatment protocols. Digital systems, like Delta Five’s TPMS, provide a superior pest management option when PMPs embrace a proactive, early alert system rather than complaint-based insecticide approaches. Furthermore, because digital systems like TPMS have provably yielded savings for hoteliers, they are poised to become the preferred means for pest/bed bug detection.

Thus, PMPs have available to them a non-insecticide tool that enables them to maximize the benefit to their clients, regardless of how near or far they are, and do so in an environmentally-conscious manner. At the same time, PMPs can enhance their bottom line by reducing the need for site visits, while leveraging the digital data (e.g., images of captured pests, analytics, etc.) to engender client trust and make informed tactical and strategic decisions. — *Jason A. Janét, CEO, Delta Five, LLC* ▲