

placed in both Section 1 and 2 to facilitate the movement of heated air throughout each test area.

**INSECT PLACEMENT.** Live bed bugs and their eggs were obtained from ICR Laboratories in Baltimore, Md. A total of 10 covered Petri dishes (seven treated and three untreated) were prepared with 10 live adult bed bugs each, and nine Petri dishes (six treated and three untreated) were prepared with approximately 100 bed bug eggs in each (see *Table 1 on page 98*). The treated and untreated Petri dishes were kept at room temperature for two weeks post treatment to observe adult survivorship and egg hatch.

Petri dishes containing the live adult bed bugs or eggs were distributed throughout the structure. In some cases, the location of a sample was undisclosed to Precision Environmental in order to simulate unknown locations of an infestation. In addition, locations were chosen to simulate not only a single family residence, but similar locations in a hotel room, i.e., areas with limited air flow, closets, cold spots because of crawlspaces or adjacent rooms.

For Section 1 (Table 1), bed bugs (Dish 1) and a temperature sensor were placed inside a master bedroom wall void that shared a common wall with the untreated garage. Bed bugs were also placed in the middle of the master bedroom between a box spring and mattress (Dish 2) and in the adjoining sitting room under a mattress placed directly on the floor (Dish 3). Bed bug eggs were placed in the master bedroom closet (Dish A), bathroom (Dish B) and sitting room (Dish C).

For Section 2 (Table 1), bed bugs were placed in a dining room cabinet (Dish 4), between the cushions of the living room couch (Dish 5), between the floor and a mattress on the floor in a bedroom (Dish 6) and in the hall closet (Dish 7). Bed bug eggs were placed on the floor in a corner of the living room (Dish D), in a particularly cold spot on the floor in a bedroom (Dish E) and in the hall closet (Dish F).

After placement of the Petri dishes, the heating process was initiated. The infrared heaters were powered on and the temperature was set to 140°F and monitored for stability. The heat exchangers were then connected by hoses and powered from a central (water) heater. The temperature on the heat exchangers was set to 170°F and monitored for stability.

**RESULTS.** After four hours of heating, we entered the structure to take initial observations. Although hot inside, we were able to spend about 15 minutes inspecting the condition of household items left in the home and observe Petri dishes containing

bed bugs. Items of particular interest, due to their suspected vulnerability to heat, were plastic cups still in their thin plastic sleeves and telephone wires from the wall to the phone. All inspected items did not appear to be affected by the raised temperature of the building.

In Section 1, four hours into treatment, all bed bugs were dead in Dishes 2 and 3 (Table 1). In Dish 1 (Table 1) all bed bugs were still alive, but clearly agitated. Observing the temperature sensors in Section 1 indicated a temperature range from 115° to 132°F (Table 1). In Section 2, all bed bugs were alive except in Dishes 5 (50 percent alive) and 6 (90 percent alive). Some of the live bed bugs in this section appeared to be agitated, while others showed no observable change in behavior. The temperature sensors in Section 2 indicated a range of 69° to 135°F (Table 1) at four hours into treatment.

Sixteen hours into the treatment, all bed bugs for all Dishes and sections treated were dead. In Section 1, temperature sensors ranged from 123° to 140°F, and the temperature sensors in Section 2 ranged from 125° to 150°F (Table 1).

All adult bed bug and egg samples were removed from the structure and transported back to the laboratory where they were observed for two weeks. None of the bed bugs in Dishes 1-7 survived the heat treatment in either section. However, all untreated bed bugs (Dishes 8-10) remained alive at the two

week visual observation period. Bed bug eggs (Dishes A-F) exposed to the heat treatment did not emerge at the two week observation period. The untreated bed bug eggs (Dishes G-I) hatched and emerged at two weeks post-treatment.

**CONCLUSIONS.** Given the results that all bed bugs and their eggs were killed after 16 hours of treatment at temperatures (in many cases) below the recommended 130° to 140°F suggests the question: What are the benefits of slowly raising the temperature when treating a structure? One obvious benefit is limiting any potential damage to building components. Paper cups in thin plastic sleeves, telephone cords, picture frames, etc., all withstood temperatures without damage during this trial. With an extended treatment time of 16 hours, an advantage to the structure is the ability for interior walls and wooden beams to have a longer “baking” time and potentially more time to eliminate the offending pest.

The infrared heaters were of particular interest during this trial since this was the first time they have been used in a structure to test their effectiveness on bed bugs. The heaters, although hot to the touch, did not burn. Additionally, if the heaters should fall over during heating they would automatically shut-off. One drawback noted was the large number of infrared heaters used during this test; however, with further research it is feasible that fewer heaters might accomplish

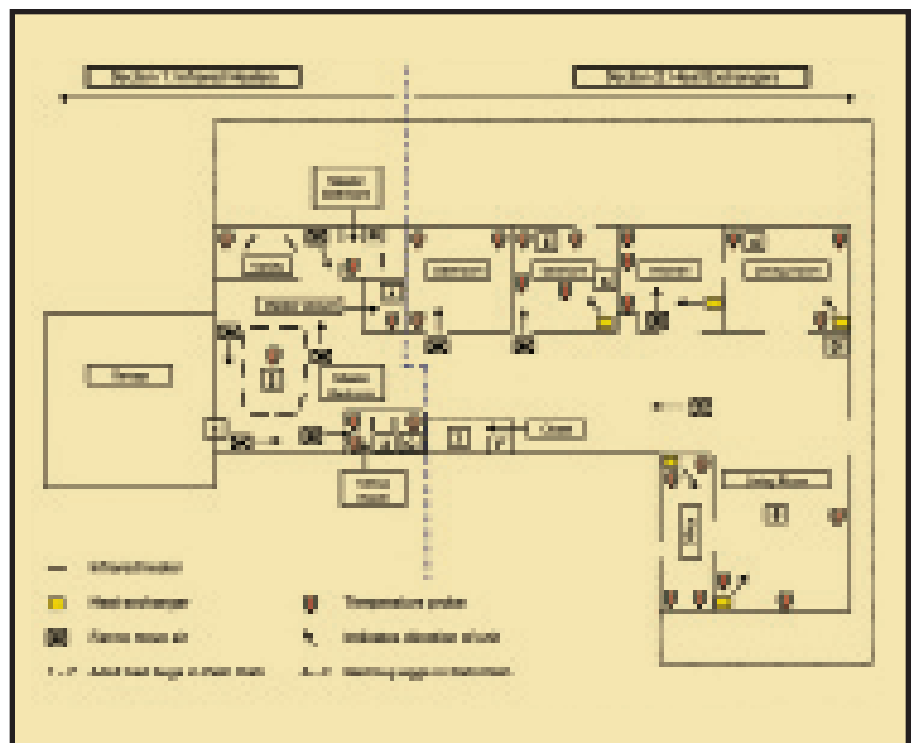


Figure 1. Plot map of the treated structure and locations of heaters, temperature probes and bed bugs for a heat demonstration in Ojai, Calif.