Evaluation of a Recirculating SAFE-HEAT® Thermal Pest Eradication Chamber to Control Commodity Pests.

A. L. Hoch[1], D. Topp[2], B. C. Zeichner[1], and Z. Mehr[3]

ABSTRACT: Thermal studies to control stored food pests and potential wood destroying insects in wooden pallets were conducted in a SAFE-HEAT® Thermal Pest Eradication (TPE) Chamber. The objectives were to determine the length of time required to heat, at a moderate temperature of 60ºC (140ºF), test materials to a target temperature of 48.9ºC (120ºF) or higher for 30 minutes in the TPE Chamber and establish the operating cost for the treatment. The TPE Chamber was developed by modifying a standard, insulated refrigeration shipping container [6.1 m (20 ft) long, 2.4 m (8 ft) wide, and 2.1 m (7 ft) high] and equipping it with a state-of-the-art recirculating heating system and six internal high-temperature fans for air distribution. Temperature profiles for the TPE Chamber and treated materials (pallets of macaroni and wooden pallets) were determined by placing thermocouples at various locations within the products and chamber, and recording temperatures over time on dataloggers. Five species of caged stored food pests (adults of sawtoothed grain beetle, confused flour beetle, granary weevil, and immature stages of warehouse beetles and Indian meal moths) were placed in the center of a number of twenty-pound, elbow macaroni boxes located at different locations within pallets of food throughout the chamber. Eight commercial pallets, 454 kilograms (1000 lb) each, of 9.1 kilograms (20-lb) boxed elbow macaroni were heat treated. None of the 1120 caged insects, representing five species, survived the thermal trial. Total energy cost for heat treating the stored food products for 49 and one-half hours was approximately $20 (ca. $9.60/day). The results of independent laboratory testing of pasta samples indicated that the food quality indicators of color, firmness, and cooking characteristics of the heat treated and control samples were not significantly different. Since wood infesting insects are also susceptible to temperatures of 48.9ºC (120ºF) or higher, a heat treatment trial with wooden pallets in the TPE Chamber was conducted at an average internal chamber air temperature of 60ºC (140ºF). Internal wood temperatures above the target temperature of 48.9ºC (120ºF) were obtained in the center of the thickest wood members [dimensions = 8.3 cm (3 1/4 inch) by 3.2 cm (1 1/4 inch), width and height] within 2 and one-half hours at a total energy cost of $1.80 (ca. 3 cents/pallet for 60 pallets). The thermal studies demonstrate that heat when produced and modulated by specialized equipment (SAFE-HEAT® Thermal Pest Eradication Chamber) is an effective method of controlling insect pests in smaller quantities of certain types of stored food products or standard wooden pallets with low operating costs.

[1]United States Army Center for Health Promotion and Preventive Medicine, Aberdeen Proving Ground, MD 21010-5422.

[2]Topp Construction Services, Inc., 12 Crozerville Rd., Aston, PA 19014

[3]Defense Logistic Agency, CAAE, Fort Belvoir, VA 22060-6219