

Controlling Insects with Heat

This nontoxic and safe treatment method is growing in popularity.

This article is based on a presentation by Raj Hulasare, senior scientist and product manager, thermal remediation division of Temp Air, Burnsville, MN (RHulasare@temp-air.com),

given at the International Association of Operative Millers' (IAOM) Pacific District meeting in Pacifica, CA, Oct. 22, 2009.

Thermal remediation is a high-temperature treatment performed in a scientific manner to eradicate stored-product pests, without any structural damage to the facility or storage structure.

Thermal remediation kills bugs safely and effectively, if you know how to apply and use the heat properly.

Heat treatment is an effective Integrated Pest Management (IPM) tool to get rid of insect infestations.

An Old Idea With A New Purpose

Using heat to control pests is not new. High-temperature heat treatments to control moths first were used by the French in the 1760s, more than 245 years ago. Heat treatment has been performed successfully by major food and grain-processing companies for the past 40 years.

Why is heat treatment making a comeback? There are three key reasons:

- Consumer preference for pesticide-free products.
- Heightened interest in eco-friendly technologies or using the "Go Green" approach.
- Increased resistance of insects to chemicals.

A Safe Method

Heat is an effective, nonchemical, nontoxic, nonresidual, and noncorrosive alternative to chemical fumigation. It is an eco-friendly approach for utilizing pest management practices, without the chemical-associated environmental or health risks to people, animals, or surroundings.

With the 1987 Montreal Protocol and the 1998 amended U.S. Clean Air Act, mandates were established to start phasing out the production of methyl bromide due to its connection with depleting the ozone layer. While methyl bromide is going through a re-registration process, its use has

been subjected to more restrictions.

The resistance of insects to phosphine and, to a lesser extent, to methyl bromide is also now an acute problem worldwide.

This is another reason for the need to increase the arsenal of methods to control insects effectively and economically. It's also why the interest in using heat treatment to control insects continues to grow.

Research on Efficacy of Heat

Comprehensive scientific data on the effects of high temperatures on various stored-product pests and their life stages (eggs to adult) was not available for many years.

Consequently, Temp Air sponsored research at the Department of Grain Science and Industry at Kansas State University (KSU) in 1999.

Temp Air offers integrated solutions to heat treat food processing plants and metal and concrete silos of all sizes, with a range of heater sizes, wireless temperature monitoring systems, and on-site training for do-it-yourself subsequent treatments.

Research findings show that most insects die in less than an hour at 122 degrees F, and all life stages are killed when exposed for more than five hours.

A Collaborative Effort

Temp Air also is collaborating actively with pest control companies, universities (e.g., Purdue University, KSU, and the University of Minnesota), and autonomous institutes (e.g., the Propane Education Research Council [PERC] and the Gas Technology Institute) to develop products and protocols for various heat applications.

For example, Temp Air collaborated with Purdue University in 2009 on a project



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funded by PERC to heat-treat on-farm bins and silos with a trailer-mounted, self-contained, propane-fueled unit (MHT-1500) that also has potential industrial applications in the organic and conventional processing industries. With partial funding from PERC, Temp Air also continues to collaborate with KSU's Department of Grain Science and Industry on U.S. Department of Agriculture and Environmental Protection Agency projects.

Patented Heat Treatment Process

Temp Air's patented heat treatment process uses 100% outside air to create positive pressure within an enclosed structure to achieve temperatures lethal to insects at all life stages. It so far has proven to be an extremely effective means of controlling stored-product pests.

The process uses a combination of direct-fired (natural gas, propane, or steam-fueled) make-up heaters, fans, and ductwork, to control the flow of air and maintain uniform temperature profiles throughout the treatment area.

The positive pressure throughout the treated space pushes hot air into corners, cracks, and crevices making it virtually impossible for pests to hide anywhere.

A dry heat of at least 120 degrees F is produced, which then is held evenly throughout the treated space, for up to 24 hours or for the time required for the application.

Heat Treatment of Processing Facilities

Temp Air has been performing heat treatments successfully during the past decade in the food industry. This includes flour mills, food processing plants, bakeries, and warehouses.

The process of heat treating a processing facility involves four steps:

1. A walk-through visit at the facility with operational staff to assess the feasibility of a heat treatment. This includes discussions on equipment and a sprinkler system that can handle high temperatures.

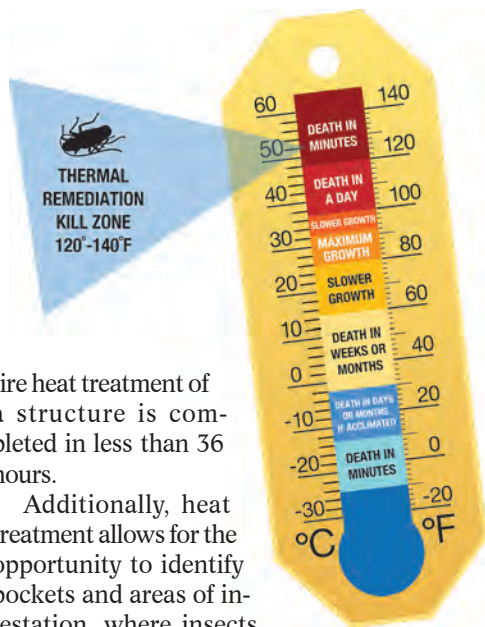
2. Developing an engineering design covering energy and equipment requirements, duct sizing, and fuel usage to esti-

mate the cost of a heat treatment.

3. Mobilization of equipment and personnel to the site for setup.

4. The actual heat treatment begins, starting first with a joint inspection before the startup. Then, the temperature is ramped up gradually, and the real-time temperature is monitored (using wireless temperature sensors) and then held steady for 24 hours. During this 24-hour period, frequent inspections are made to monitor insect activity and to identify any cold pockets that may need fixing.

Afterwards, the treatment area is cooled down, and the treatment is documented, in order to generate a final wrap-up report that can be discussed with the customer. The en-



tire heat treatment of a structure is completed in less than 36 hours.

Additionally, heat treatment allows for the opportunity to identify pockets and areas of infestation, where insects still may survive and thrive in the treated area(s).

During the 24-hour treatment period, observing the insects' activity and movement from hotter areas to cooler areas and looking for any signs of re-emergence in the cooler areas make it possible to identify the critical spots of infestation.

During a heat treatment, inspections can be made to identify areas of insect emergence from cracks or crevices. A subsequent treatment of cracks and crevices then can be done after the main heat treatment.

Limitations of Heat Treatment

There are a few limitations to using heat to control insects.

For example, Temp Air discourages heating products in warehouses. Food and stored products are good insulators, and the heat may not penetrate the products well, and it also may alter the properties of the product(s). Heat also may damage packaging materials such as plastic.

Advantages of Heat Treatment

- Heat kills all the life stages of insects, from egg to adults, unlike chemicals, where higher dosages may be required for egg-kill.
- Heat is nontoxic, noncorrosive, and non-residual.
- An entire facility or sections of the facility (spot treatments) can be heat treated, while other areas remain operational.
- No mandatory evacuation in adjacent untreated areas, such as a warehouse, shipping area, or office, is necessary. These areas can function normally.
- No extensive sealing required, except for the doorways and exit points.

Similarly, treating a bin or silo full of product is not advisable, as the quality parameters of the stored product or commodity may become altered. However, heat treating empty bins and silos can be extremely effective.

Heat Treatment of Bins and Silos

Temp Air has been very active in offering heat remediation solutions for treating empty bins and silos on



A typical heat treatment installation showing ductwork and fans to distribute hot air and manage the airflow.

farms and in food processing plants.

Presently, empty on-farm bins and silos are fumigated chemically or treated prior to harvest and loading fresh grain. The floors of bins and silos accumulate broken grain and fine matter that harbors insects and mold spores.

In milling and grain handling facilities, residual insect populations in bin hoppers and floors can become a major source of reinfestation, as grain gets warmer. In some cases, chemical treatments may not penetrate well into a mass of insects, or the insecticide spray may drip through the clogged perforated floor but still not reach the insects in the spoiled grain underneath the screen.

Also, blowing diatomaceous earth through the fan doesn't guarantee uniform application, and phosphine fumigation requires a licensed applicator. Using heat to treat bin floors and other grain holding areas can overcome these obstacles.

Karl Ohm, associate editor



At this facility, a two-tiered heating unit is set up with the proper ducting to deliver enough dry heat during a 24-hour period to control stored-product pests.