An Introduction to Thermal Remediation from TEMP-AIR
A Patented Process to Eliminate Pests with Dry, Clean Heat
An Effective, Safe, and Economical Alternative to Methyl Bromide

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The process of using heat as a method of controlling pests is termed “heat sterilization” or “ heat treatment.” This method of using high temperatures to rid enclosed structures of insects has been used since 1900’s. During heat treatment, the ambient air of all or parts of a facility is raised to temperatures that are lethal for insects.

Although heat has yet to achieve the popularity of chemicals, it has been proven to be more effective in killing insects. As methyl bromide continues to be phased out, heat is gaining more popularity and recognition as a viable and safe alternative to chemicals and fumigants.

Research Findings

Over the past several years, researchers at Kansas State University have been collecting data on the use of heat to effectively kill insects in food processing facilities. Their research found that insects die in less than an hour at 122 ^{o}F. They also found that temperatures of 122 ^{o}F, held for three or more hours, kills all exposed life stages of the red flour beetle and other stored product insects. During heat treatments, the lethal temperatures should be held for up to 24 hours for better air distribution and penetration of areas where pests hide, like cracks, crevices and electrical conduits.

TEMPERATURE RANGE	INSECTS’ RESPONSE
95 – 107.6 ^{o}F	**Lower survival; prolonged developmental time; reduced egg production; insects seek cooler environment**
107.7 – 113 ^{o}F	**Death in less than a day**
114 – 122 ^{o}F	**Death in less than an hour**
143.6 ^{o}F	**Death in less than a minute**

Case Study (Facility that used methyl bromide and now uses heat treatment.

TEMP-AIR has worked with food processing plants that switched from methyl bromide to Thermal Remediation.

- A rice mill used methyl bromide until 2000. In 2000, they received an initial quote for a fumigation of $26,000. Unfortunately, the building was very leaky and would not hold the needed concentration of gas. More gas was added, raising the cost to $32,000, and it did not kill 100% of the insects.
- In 2001, the rice mill switched to heat. The quote was $31,500. The leaky building actually provided better heat distribution and the treatment achieved 100% kill.

Overview of Process and Equipment

Engineering the heating of food processing plants to achieve a higher temperature to kill insects is a simple task. We calculate the heat loss through the structure, determine the air flows to pressurize the building, layout the delivery system (using fabric ductwork), and select the correctly-sized make-up air heaters. We work with the customer to identify heat-sensitive equipment and building components and either remove or protect them. We finally specify the fuel and electric service requirements.

Once the equipment is in place and all safety protocols are completed, we begin the heat up. There is little preparation required other than closing doors and sealing large vents, unlike fumigation. We typically raise the temperature 10 F per hour to avoid thermal shock. We achieve the design temperature and hold it for up to 24 hours. Insects will die within one hour of exposure. The additional 23 hours is “overkill” to ensure that the walls and foundation are thoroughly heated and no insects escape their doom.

The critical issue in performing a heat treatment is control. We must achieve the minimum temperature of 120 F and hold if for 8-24 hours. We must also avoid overheating the structure to prevent damage, usually limited to 150 F. Maintaining the thermal envelope is essential and we have three tools:

- TEMP-AIR developed a wireless remote temperature sensor system with a laptop datalogger. We place up to 200 sensors at critical places, such as on outside corner floors or sensitive equipment. We can monitor the temperature in real time and make adjustments as needed. If an area is not heating up, we can increase the output of the heater or move fans to blow heat into a depression. If equipment is too hot, fans can blow the heat away. The datalogger provides documentation of the entire heat treatment process and it reduces worker exposure to higher temperatures.
- TEMP-AIR’s THP direct-fired make-up air heater is ideal for heat treating. It can provide 10% of its maximum input because of the

modulation system and ranges from 60,000 to 4,500,000 Btu/hr of heat and 2,000 to 27,000 CFM. It runs on natural gas or propane with 92% efficiency. Its low discharge temperature (maximum of 240 F) reduces the risk of overheating. Both fuel and air flow can be adjusted for precise control.

- TEMP-AIR technicians are the best in the world. They remain on-site throughout the heat treatment to make adjustments or service the equipment. The only factors they cannot control are power outages or fuel supply disruptions.

(It should be noted that TEMP-AIR also maintains a fleet of conventional construction heaters (direct flame), electric heaters, and steam heaters. We can use this equipment, but the preferred option is the THP make-up air heater.)

At the conclusion of the heat treatment, the burners are turned off and the blowers continue to blow air into the building to provide rapid cool down. The heaters are disconnected, the remote sensors collected, and the fabric ductwork removed and stored. The plant is ready to resume operations within two hours or less. The entire treatment will take less than 36 hours.

One of the most important considerations and benefits of a heat treatment is safety. Unlike fumigation, there is no toxic gas used. Workers and plant personnel can enter the treated zone at any time. It is essentially a sauna. This permits the IPM and QA teams to inspect the facility and visually determine where insect activity is occurring as heat is making them uncomfortable and start seeking cooler spots (for better future treatment). This also enables other activities in the plant to continue. Fumigation will require total evacuation within 500 feet. Thermal Remediation can accommodate maintenance, shipping and administrative activities.

Limitations

There are several areas where Thermal Remediation is not applicable. We discourage heating warehouses full of finished product. The heat will not penetrate product. It may damage the packaging material (plastic) and it may alter the properties of the stored product. The finished product should be removed and chemically treated. The warehouse can then be treated with heat. The same is true for bins or silos full of product. Again, the heat will not penetrate. Treating empty bins is very effective and can solve many infestation problems.