mold™
& MOISTURE MANAGEMENT MAGAZINE
The Magazine for Moisture Prevention and Remediation
March-April 2006
Volume 3 | Issue 2

Free Subscription Form on Page 35

# Remediation Scope: The Latest Techniques and Tools

ALSO INSIDE:

PREVIEW OF AIHCE 2006

15 STEPS TO A SUCCESSFUL MOLD INSPECTION REPORT

A Publication of Key Communications, Inc.

# Some Like It Hot

## How Heat Has Become a Tool for Mold Remediation

With containment barriers and heating equipment in place, hot air was ducted into the Tropicana Gardens student housing facility to remediate its mold problem.

By **Megan Headley**, editor of **Mold and Moisture Management** magazine.

High heat mold remediation (HHMR) is not a mold remediation tool that can be mastered through an online course or during one or two weekend classes. The use of heat to rid a structure of mold growth is a complex process that requires extensive training and a thorough knowledge of building science but its advantages are many, according to individuals familiar with the process.

"When it's done right, nothing else compares," said Michael Geyer, P.E., C.I.H., C.S.P., president of Bakersfield, Calif.-based Kerntec Industries, which employs heat as one of its remediation techniques.

### Like A Heat Wave

Although he has been engaged in the environmental arena for more than 20 years, David Hedman only began developing heat treatments for mold remediation in 2000.

"The concept of using heat in structures was really brought to me by two professors at UCLA, Dr. Walter Ebeling and Dr. Charles Forbes," said Hedman. "They found that moderate temperatures, 120° to 130° Fahrenheit, were lethal to most insects."

The professors approached Hedman with their findings, and "they asked me if I thought there were environmental applications," he recalled. "I was very excited about the technology."

The use of heat had also been evaluated by the EPA in 1996 in a study called *U.S. EPA Heat Treatment on Imported Timber*. The study considers the use of heat treatments a "viable method" to reduce insects and fungi on lumber. In January 2000, Hedman and his business partners purchased the technology to learn how to expand the application of heat to control mold and insect problems in residential, commercial and industrial structures. E-Therm Inc., headquartered in Ventura, Calif., currently holds six patents on HHMR

## Heat Eradication Chart

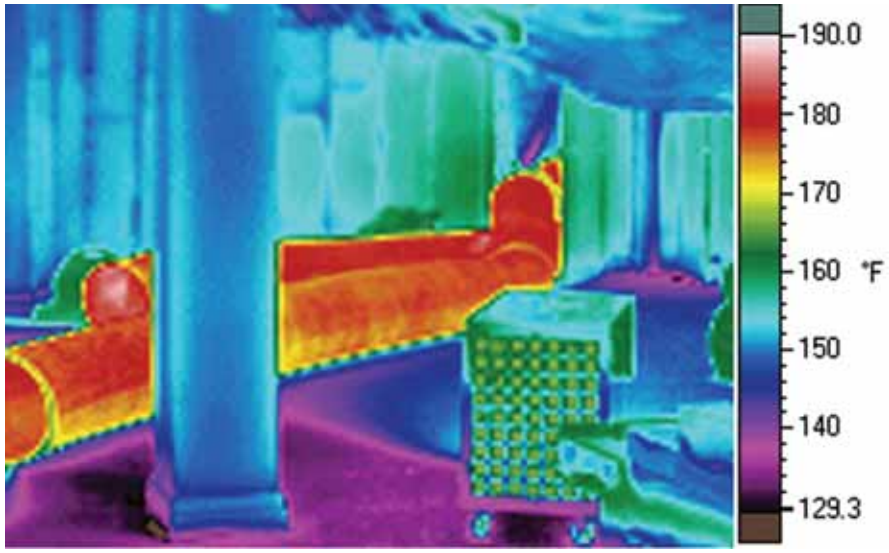
| Target Contaminant Mold | Lethal Temp | Duration | Reference |
|---|---|---|---|
| Stachybotrys chartarum | 140F / 60C | 30 Minutes | Compendium of Soil Fungi, pg., 745 |
| Aspergillus alutaceus | 144F / 62C | 20 Minutes | Compendium of Soil Fungi, pg., 82 |
| Aspergillus ustus | 144F / 62C | 25 Minutes | Compendium of Soil Fungi, pg., 119 |
| Aspergillus niger | 145F / 63C | 25 Minutes | Compendium of Soil Fungi, pg., 103 |
| Alternaria alternate | 145F/ 63C | 25 Minutes | Compendium of Soil Fungi, pg., 36 |
| Wood Fungi (Staining Fungi) | 151F / 66C | 75 Minutes | Compendium of Soil Fungi, pg., 106 (Chidester, 1937, 1939) |
| Poria – Wood Eating Fungi (Meruliporia Incrassata) | 151F / 66C | 75 Minutes | Compendium of Soil Fungi, pg., 106 (Chidester, 1937, 1939) |

*Source: Precision Environmental Inc.*

techniques and about 20 trademarks, including one for the brand name ThermaPureHeat™.

HHMR, used in conjunction with gross removal of moldy materials, is able to destroy mold growth in wall cavities and other hard-to-reach areas that otherwise may not be remediated without extensive destruction, according to Hedman.

Hedman said, "A lot of people ask us, are we replacing gross removal? Absolutely not. We use [heat] in conjunction with gross removal. If we see visible mold growth in a structure we're removing that."




**Thermal imaging cameras can tell heat technicians if a building is heating evenly or if there are pockets of cooler air that need to be fixed.**

### Heating Things Up

Heating a building enough to kill mold spores isn't a matter of turning the thermostat up.

"Basically, the temperature of the structure is increased slowly using a variety of types of equipment," explained Larry Chase, vice president of E-Therm.

Temperatures are raised up to between 140° and 150° Fahrenheit for several hours (*See Heat Eradication Chart above*). But it takes a lot of work to get to that point.

Before the temperature is raised, the area is surrounded with a plastic containment barrier to confine the mold spores and protect the structure. HEPA-filtered negative air machines create a vacuum that eliminates any leaks in the containment and captures airborne spores. Then, visible mold is removed and damaged building materials are replaced by the technicians.

Next the equipment to heat the area is put in place. Heat is forced into the containment through flexible Mylar ducting. The heaters themselves, according to Chase, can be as small as a Salamander portable heater or as large as a crate-mounted unit, depending on the size of the contaminated area. The type of heat also varies. For fungi in high-rise buildings, a technician might choose an electric heater over propane. For a residential setting, a hydraulic heat exchanger, where heat is transferred via liquid, could be the best choice.

The company doesn't manufacture the equipment that heats the buildings, but finds that many options already on the market are suitable for their technicians' work. They recommend heating equipment that has been registered to the EPA in compliance with the Federal Insecticide, Fungicide, Rodenticide Act.

To keep the heat even throughout the structure, fans are required.

"If you don't have a lot of fans to stir up the air then all of a sudden the ceiling is 200° and the floor is 80°," Geyer said.

In principle, the process works much like a convection oven, in which a fan circulates the hot air so that food is evenly heated.

### Tools of the Trade

Although the heat is clearly the cornerstone of the process, filtration is probably the most critical step. Hedman can't stress that point enough.

"While we're heating, we always use filtration," Hedman said. "Heat does give us lethal temperatures that will kill microorganisms, but one of the largest benefits of our company is running our

*continued on page 22*

# Some Like It Hot
continued

## Mold Growth in the Gardens

Kent W. Dunn would agree with David Hedman that it's the whole process, not just the heat, which gives heat success as a remediation tool.

Dunn was an investor in Tropicana Gardens, a housing facility in Goleta, Calif., for students of University of California Santa Barbara (UCSB) and Santa Barbara City College (SBCC), in 2005 when the university was looking to purchase the 40-year-old building. The deal nearly went to pieces when a mold problem was discovered.

**Technicians took approximately one week to heat each unit in the Tropicana Gardens student housing facility.**

In the process of buying the facility, the university did testing on the premises, and found high concentrations of moisture behind a number of the wallboards, particularly near the bathrooms. Other problems soon began to emerge. A roof that hadn't been replaced for 40 years had leaks throughout. Previous owners had stacked layers of flooring one upon the other, with mold growing between layers of linoleum.

In March 2005, a contractor friend of Dunn's suggested learning about heat to remediate the mold. That's when a team from Precision Environmental Inc., which uses the ThermaPureHeat process, was brought onto the site.

Dunn was eager to learn about the technology. Although, upon the recommendations of a consultant, the investors had overseen the work of ripping out moldy wallboards and replacing flooring, Dunn was still concerned about the safety and health of students in buildings that wouldn't need to be fully renovated. Armed with the knowledge that mold problems could exist without any visible indication, Dunn felt that the heat treatment would be a good way to take care of any potential health issues in the housing units that were not on the list for remediation.

"I wanted to be able to tell parents that we had taken care of the mold problem everywhere we had found it because we had used the process throughout the property," said Dunn.

During the 2005 summer, technicians with Precision Environmental spent at least a week applying the heat technology to each unit, working around summer camps and guests.

Technicians used Salamander portable engines due to the layout of the units.

"Of course it was all contained," Dunn said. "They essentially draped the building like you see done for a termite test."

The work finished earlier than the investors had projected, with final testing being done throughout August and the "all clear" given September 2.

"So far we haven't had any readings that are anything other than ambient levels," Dunn said.

Additional testing is scheduled for this summer, as part of the university's new mold management plan.

air scrubbing and negative air components while running the heat treatment."

"In fact," Hedman continued, "the process may be dangerous if we were not using those air scrubbers."

Hedman warns that the desiccation of the fungi particulates helps the spores to become brittle, and the blowing fans push those pieces into the air, potentially spreading the mold contamination.

Geyer said, "I've seen people heating without the air filtration. They're baking out the water. Without the air filtration … they're leaving behind a huge residue."

Hedman has worked with various manufacturers to create air scrubbing equipment with motors and filter fabric able to withstand the high temperatures.

So that heat technicians can ensure that the heat is distributed evenly and that sensitive materials remain safe, a variety of other tools are used. One example is remote probes attached to computers that can relay temperatures back to the technician. This is key when ensuring that no pockets of cool air are left.

"The key to efficacy is reaching uniform temperature throughout the structure," Chase said.

Thermal imaging cameras are another tool that proves useful.

"The one thing the imaging cameras really provide is real-time data so we can modify the heat delivery equipment in a real-time basis," said Geyer.

He added that since every building "behaves differently," adjustments are made on every job.

"Buildings aren't cookie-cutters, they behave differently, and the thermal imaging cameras allow us to … get feedback on a real-time basis."

*continued on page 24*

# Some Like It Hot
continued

**The size and type of heater used varies depending upon the layout of the building and scope of the problem. The only constants are the need for containment and filtration.**

## Handling the Heat

Through the development of the process—and some trial and error—technicians have learned what materials can handle the heat.

"Heat can damage things in buildings," Hedman said. "We have learned through sad experience that it's easy to damage things."

As Kent W. Dunn pointed out, technicians can't always be sure which items will have pieces that can be damaged by the process. He oversaw the remediation in the University of Santa Barbara student housing facility, for which he was an investor (*See Mold Growth in the Gardens, page 22*). The rooms each had heaters with plastic pieces inside, and in a few cases where the Salamanders were pointed directly at the heaters, the technicians ran into problems.

"Some of the pieces melted, and we didn't know it until November when we turned the heat on," Dunn said.

For the most part, technicians have learned to remove sensitive materials or find ways to protect them from the heat.

"We're below temperatures that your car will achieve in a parking lot on a summer day, so anything that you would not leave in your car … we remove," Hedman said.

Hedman also recommended that if a company is going to use the process, that they have a certified industrial hygienist test for pre- and post-verification standards.

## Intensive Training

Comparing the HHMR to "pasteurization" or a "convection oven" makes it seem easy to understand, but proper application requires an intensive level of training.

"I think there're some firms out there that have thought that heating is easy," Geyer said.

Geyer added, "You have to understand a certain amount of building science, thermal mass, convection and how important these air exchangers are."

Training remediators to use the process is necessary because there are extensive considerations to take into account, and they typically differ with every building treated. Without using proper filtration, spores will be able to settle in new areas. Without addressing the source of the moisture intrusion, the mold problem will begin anew. Without consistent heating, mold may actually be encouraged to grow.

"If someone tries to heat and doesn't understand the technology or building science, and has pockets sitting in 90° to 100° Fahrenheit, that is perfect for incubating mold," said Geyer.

The cost of this investment is approximately $3,000 per state per month (the process is licensed on a state-by-state basis). In addition, Hedman's company receives 5 percent of the gross profit. This cost includes training on how to use the technology and continual assistance.

The average cost to customers currently ranges between $1 (for builders looking to dry framed construction only) to $5 per square foot.

## To Heat or Not to Heat

Hedman stressed that another significant benefit of the heat technology is that it does not use chemicals to treat the environment.

"Our job is to clean up the environment," Hedman said. "I'm really excited about bringing forth a technology that can replace a significant pollution stream."

Geyer added that the process is also useful when it comes to remediating historic structures, where building materials must be preserved.

"It has a broad base of applicability," Geyer said. "A very good process for the scalability…and it does treat a wide type of building types," Geyer said.

Hedman said that the trend to build buildings that are more resistant to heat, as a result of building code changes, as well as new technology, has allowed E-Therm to bring this process forward.

"It's not as simple as bringing up heaters … and heating things up," said Geyer. "It all needs to be controlled—but if it's under control, boy does it deliver." m

**Look for "Cold" Technologies in our next issue.** Hot&Cold