A Publication Of Business News Publishing Co.
www.PMmag.com
May 2003/Volume 21, Number 3

PM
Plumbing & Mechanical

- ISH Frankfurt Photo Album
- Detecting Leaks For Profit

Is There Anything *Radiant* Can't Do?

BY STEVE SMITH

Is There Anything Radiant Can't Do?

Radiant

The flexibility of radiant tubing offers almost unlimited potential for its use.

When everything's said and done, radiant tubing is basically a low temperature heat exchanger. And that basic job description is what accounts for installations that almost defy description.

About the only reality that holds radiant creativity back is the cost. Everything else is fair game.

We've reported on unusual installations before and heard about even more. According to the Radiant Panel Association, 192 million linear feet of radiant tubing was produced by North American suppliers in 2001. The RPA will report on the 2002 tally at this month's convention.

Let's look at a few cases in which some of this tubing went into some places you'd least expect, but most want:

And Radiant Cooling, Too

One of the laments heard about radiant systems is that they work great for heating. But radiant cooling? That's another matter.

Radiant systems may not have the same inherent advantages for cooling purposes as they do for heating, but a two-story, 160,000-sq. ft. warehouse conversion in San Francisco offered an opportunity to showcase radiant heating and cooling.

Pier 1 was originally built in the 1930s as a sugar warehouse and sits several hundred feet directly over San Francisco's east bay. As a result of its origins, the space was never meant to be heated or cooled.

To meet the structure's historical preservation requirements, developers were not allowed to insulate the 4-inch thick concrete walls or obstruct the exposed beams and rafters with ductwork.

Clearly, radiant was the only option for heat. Nearly 132,000 feet of 3/4-inch REHAU tubing was installed 10 inches on-center in approximately 250-foot circuit lengths. The circuits were placed on an existing concrete slab over a layer of insulating bubble foil, directing the heat through the carpeted floor.

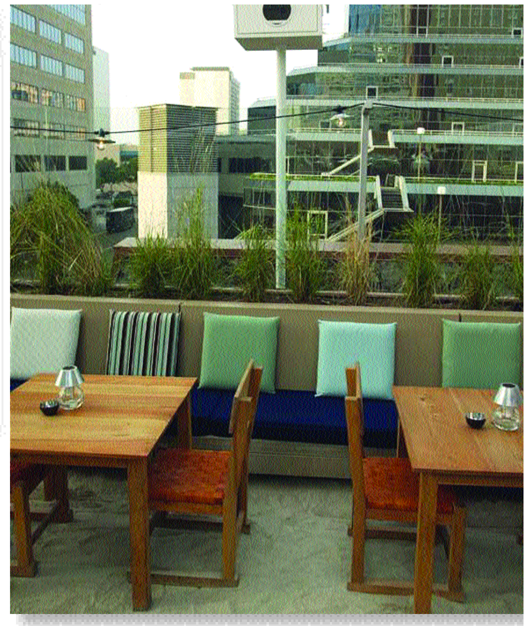
In designing the Pier 1 system, engineers also realized that the system could also be used for cooling by tapping into the bay water itself as the source of cool water. The specially designed closed loop system uses pumps to circulate water through still more REHAU PEX tubing that is positioned directly in the bay under the pier.

Humidistats placed throughout the interior prevent the floor temperature from dipping past the dewpoint.

The radiant cooling system is also augmented by ceiling fans and natural ventilation, controlled by windows, some of which are electronically opened only when the interior temperature rises above 75 degrees F.

At night, motorized windows in the clerestory open to use cooler night air to pre-cool the space for the day ahead.

The Beach Bar



The trendy W Hotel group's San Diego operation has an interesting place to stop in for a drink. The Beach Bar is quite literally that — a 2,000-sq. ft. open-air lounge with a foot of radiantly heated sand to sink your toes into.

Here are a few of the design highlights supplied to us by **Jim Bishop**, senior project manager for mechanical contractor Critchfield Mechanical, Menlo Park, Calif.

• The radiant system consists of several layers. First is the structural slab, specially reinforced to support the enormous weight of all that sand. This is followed by many layers of thin foam for insulation purposes, plus waterproof membranes. "After all,this is out in the open roof, exposed to rain," Bishop says. "These various layers are installed at the right pitch, but which is undetectable to people because of the level sand surface."

• Resting above this is the actual heated slab, Watts Radiant Onix tubing covered with 2 1/2 inches of lightweight concrete — covered up by 12 inches of sand.

• A slab sensor, similar to what you'd expect in a snowmelt job, controls the temperature. "The sensor is sealed in an accessible, waterproof metal container and is located in a good spot for an average slab temperature reading," Bishop says.

• The system was designed to have a maximum sand surface temperature of 80 to 85 degrees F — a "neutral feel" temperature for humans. "The sand surface does not, and will not, feel hot to the touch, but it is certainly warmer than what it would be without the heat," Bishop adds.

To achieve this temperate temperature on top, the system was designed to run at temperatures of 100 degrees from the bottom of the heated slab. "The temperature increased about 2 degrees for every inch of depth in an area where the sand thickness was 12 inches," Bishop says.

• Heat loss when wet? "Sure, the sand gets wet when it rains," Bishop explains. "But the moisture actually increases the conductivity of the sand, more than compensating for the heat loss from slow evaporation."

In addition to the sand "floor," the space also includes a radiantly heated bench that wraps around the perimeter of the lounge.

Naturally, the heated sand drew lots of attention with club hoppers standing in line on Friday and Saturday nights for a space that can hold less that 200 patrons. The hotel reportedly went through three months worth of booze in just the first month after opening the Sand Bar.

In fact, hotel owners were so impressed by the system that they wondered if the temperature of the sand could be made hotter.

The simple answer was no, with the complexities of why having to do more with the radiant ability of sand than the mechanical system. "Hot sand that we have all experienced on a bright sunny day is not possible in this case," Bishop says. "That sand is heated from the sun above. We are heating from below."

After examining the request, Bishop told owners that any temperature higher than 85 degrees F would be uncomfortable. Besides, a large increase in supply temperature would increase the sand surface temperature by only about 2 degrees. Although the surface temperature would only go up a little, the temperature at the top of the slab, and in the first inch or two of sand, would increase substantially.

"Even if the sand on the surface could be made to be hot to the touch, the sand just a few inches below the surface would most certainly be a burn hazard," Bishop says.

The Lighthouse

When homeowner **Alan Haar** decided to build atop a lakeside mountain, he wanted a home with expansive views of the countryside and interior spaces with few dividing walls. He also wanted to see the lake.

The surrounding forest, however, prevented unobstructed views of the lake.

"There was only one way to do it," he says. "Over the top."

The design he settled on was influenced by his long fascination with old lighthouses. Built like an octagonal wedding cake with each successive layer in smaller size, the home's top floor would feature 360-degree, eight-sided walls of glass with a view over a canopy of trees. Inside, an intricate framework of exposed beams would support the structure's mass with few interior walls.

But installing the mechanical systems presented new challenges. With so many exposed walls and ceilings, how would they facilitate heating, air conditioning and plumbing?

"Timber-framed structures, by their design, challenge the proper installation of mechanical systems," says **Tony Zaya**, Lancaster County Timber Frames, Lancaster, Pa., an architect specializing in timber-framed homes.

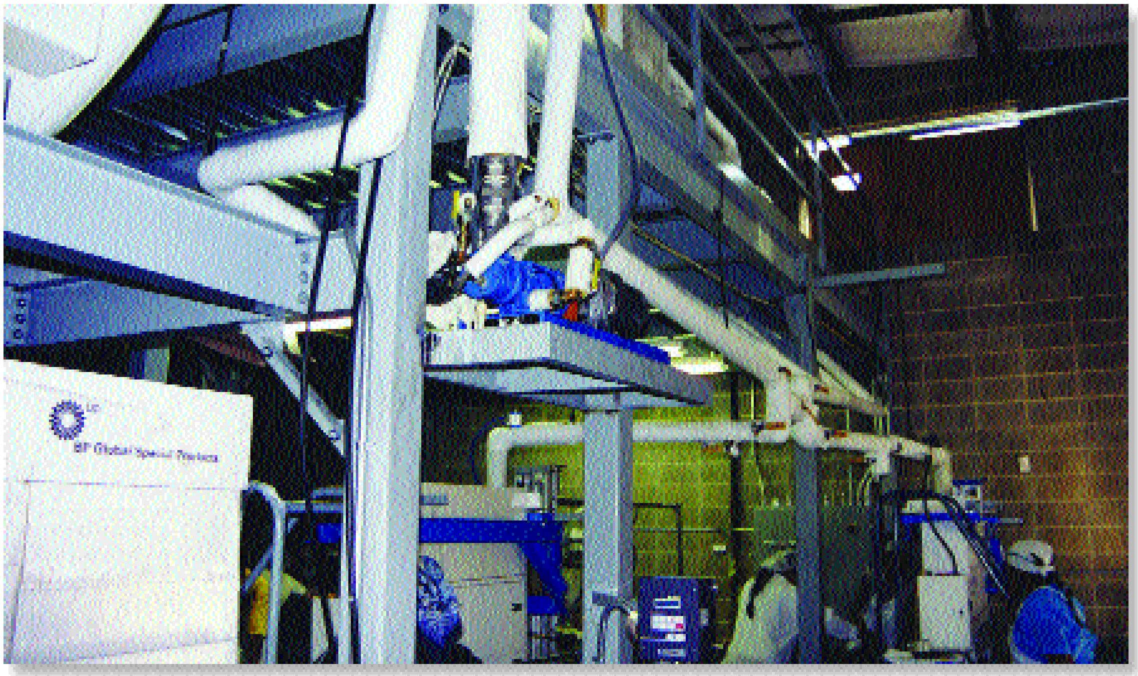
Already limited for concealing the heating, plumbing and drainage pipes, Zaya's design challenge was multiplied by the central opening up through each successively smaller floor.

The ground floor concrete slab was tubed with home runs to the main manifold for zoning flexibility between bed and bath groups. The upper hardwood floors cried out for radiant heating. But the 6-inch truss joist space was too narrow to house the PEX plumbing system, the electrical wiring, hi-velocity A/C ductwork and a plated under-floor radiant application.

Zaya solved the problem by using Watts Radiant SubRay, specially manufactured subfloor various manufacturers make that provides more flexibility for contractors to install radiant tubing.

Given the octagonal construction and soon-to-be-installed pie-shaped wedges of hardwood flooring, Zaya needed a product with this type of space-saving design flexibility for diverting tubing runs around the massive timbers and where each of the eight floor sections abut the other.

Hot Wax



Radiant tubing can do much more than just provide a room with warmth. That cozy comfort can also improve on commerce.

A few years ago, for example, we saw pictures of a 500-foot-long radiantly heated casting slab, used to cure concrete walls to deaden the sound between noisy freeways and residential areas.

The foot-thick walls are poured out on slab, located outside in the Arizona desert. Before radiant, the company would rely on the sun to cure their walls. But sunshine took three days; combined sun and radiant brought the wait time down to just one day.

We've also seen pictures of a honey processing plant in Pennsylvania, in which radiant kept the honey in a warm, easy-to-pour state without the worry of easily scorching the sugar.

What works for honey also applies to wax. For Every Body, a Lindon, Utah, manufacturer of candles, was looking to construct an assembly line to speed production to meet demand. The process called for transporting raw, molten wax from three storage tanks via stainless steel piping to five mixing tanks, where the material was colored and scented.

"They were selling candles faster than they could make them so they wanted to build a complete assembly line to speed production," says **Dave Told**, Told Plumbing, Pleasant Grove, Utah."Heating the tanks seemed easy enough, but it was keeping wax hot while it traveled between the tanks."

Otherwise, one really big candle.

Told first considered wrapping all the pipe with Wirsbo PEX and then insulating it. In the end, however, it worked better to pair PEX and modified heat emission plates, then spacing them evenly around the stainless-steel piping. Afterward, all the pipe also was insulated.

A Weil-McLain PGF 8 boiler maintains a temperature of 200 degrees F in its 3-inch primary loop that is in continuous circulation. The three large storage tanks that hold the wax are each equipped with a zone pump, controlled by a tekmar 150 set point control that uses four 071 sensors, placed in various locations within the tanks, to monitor the temperature of the wax.

"When there is a call for heat for the tanks, the zone pump pulls it out from the main loop," Told explains. Heating for the radiant tubing is also pulled off this using another zone pump. Since the loops supplying the piping vary dramatically in length, a flow-control manifold simplifies the balancing act.

According to the manufacturer, the plant can go from a "cold start" — with all the wax in the tank and piping completely solidified — to complete liquefaction in one to two hours.

Animal House(s)

No doubt radiant heat provides creature comfort for humans, but how about creature comfort for other creatures?

Although rooftop HVAC provides the primary source of heat for the 7,800-sq. ft. Elephant House at the Indianapolis Zoological Project, Indianapolis, radiant was still installed to dry the floor quickly, prevent animals from slipping and keep the animals' feet warm.

The Wirsbo PEX system, fed by a 200,000-Btu Viessmann boiler, has different zones,allowing some areas to be kept warmer than others for, say, newborns. In this case, the most unusual aspect is the location of the manifolds. Rather than positioned in a wall, the manifolds are actually buried in the slabs in specially designed boxes.

"Elephants like to stand on their hind legs," says **Brian Emmons**, manufacturers rep for Lee Hydronics, Monee, Ill. "With their trunks in the air, their reach is enormous. With the manifolds buried in the slab, there's no way they can do any damage."

If radiant makes sense for warm-blooded animals, then it's that much better for cold-blooded reptiles.

Wirsbo also donated the tubing for an exhibit housing two Komodo dragons at the Minnesota Zoo. The space was designed to provide the lizards from Indonesia with temperatures of 80 to 100 degrees F. In order to keep the animals moving, the space includes six zones, including three floor zones and three "basking rock" zones. *PM*