NOTEBOOK

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When Copper Goes Bad

Pinhole leaks in copper tubing leave experts scratching their heads

Copper has been successfully used for water supply piping for more than 70 years, and is perceived as the industry standard. Consumer confidence in copper is high, and the material has an earned reputation for quality.

Copper tubing failure is rare. But corroding copper tubing has recently been reported in cities as far apart as Phoenix, Ariz. and Andover, Mass. Other cities reporting problems with pinhole leaks in copper include Saugus, Calif., Lima, Ohio, and Jacksonville, Fla. In Jacksonville, the problems were so serious that the city, in an unprecedented step, banned the use of copper for residential water supply piping.

In areas where pinhole leaks in copper tubing do occur, entire neighborhoods can be affected. In Highland, Calif., one developer, Richmond American Homes, spent $275,000 fixing leaky copper tubing over a four-year period. With 67 homes involved, the repair bill averaged over $4,000 per house.

This photo shows a section of copper tubing removed from an elderly housing project in Lyndonville, Vt. A series of pinhole leaks caused damage to interior finishes.

Leaks underground. Jim Edwards, an estimator with W. J. Maloney Plumbing Co. in Phoenix, has had first-hand experience with copper corrosion. A leak in the copper tubing under the slab in Edwards' own home cost $7,800 to dig up and repair, and he believes that aggressive soil was responsible. "If the house happens to be in a certain area, the pipe will just eat away," said Edwards, who reports that problem soil is found throughout Maricopa County in Arizona. Some Phoenix builders install foam pipe insulation on any buried copper, and bed the pipe in sand before backfilling. "If you do these two things, the pipes may last 20 years, but who knows?" said Edwards. "In areas where the soil is really bad, I've seen the pipe go in as little as 6 years."

Garry Gage, owner of Garry Gage Plumbing in Rialto, Calif., has seen many failures of buried copper tubing in his region, so he takes a conservative approach. "When doing new construction, my company

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Moldy Basements Blamed for Infant Deaths

In the last few years, 16 infants in the Cleveland area have died of unexplained pulmonary hemorrhage, and a number of similar cases have been reported in Chicago, Milwaukee, and Detroit. According to Dr. Dorr Dearborn, a Cleveland pediatrician, the cause of the infants' deaths was the inhalation of stachybotrys, a toxic mold found growing in the damp basements of the inner-city homes where the babies lived.

The black mold grows on wet building materials, especially gypsum wallboard. "When you have wallboard that gets saturated, you are set up for stachybotrys," says Dr. Dearborn. He believes that the stachybotrys spores, when inhaled, can damage the blood vessels in the lungs of infants, and can cause non-lethal respiratory problems in older children and adults.

Since January 1993, there have been 44 cases of unexplained pulmonary hemorrhage in Cleveland, and 140 nationwide. Dr. Dearborn says that in all but two of the 29 cases he has had as patients, stachybotrys mold has been documented in the homes. Smoking by family members may have also been a contributing factor in the deaths.

Dr. Harriet Burge, an expert in airborne diseases at the Harvard School of Public Health, doubts whether the exact cause of the cluster of Cleveland deaths will ever be known. "Mold may have played a role. There was mold in many of those houses. But there is not good evidence that stachybotrys itself was the cause of the problem." She bases her skepticism on the nature of the fungus spores. "The spores are very large and very sticky," she says. "When it comes to getting the spores into the lungs of a baby, the physics just don't match."

Although stachybotrys is very common — "it grows in everybody's basement," says Burge — it should be approached with caution. "Stachybotrys is very toxic, there's no doubt about that at all," she says.

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won't put copper pipes in the ground," says Gage.

Pinhole leaks indoors. Joe Hoffman has been working as a plumber in Andover, Mass. for more than 50 years — and for the past 8 years, he's been busy repairing leaks in copper pipes. "The copper pipes get green spots, and then they just start dripping," says Hoffman. "We've had to repair pipes in hundreds of houses. In a lot of houses that are less than ten years old, we have had to replace all the pipes in the house. Some places, we've put in new pipe, and then the leaks happen again three or four years later. There are neighborhoods where we've done five or six houses on the same street."

When copper tubing fails under a slab, repairs can get expensive. It cost $7,800 to repair the failed copper tubing under the home of Jim Edwards, an estimator for W. J. Maloney Plumbing in Phoenix.

What's Causing the Problem?

Several possible causes of copper tubing failure have been suggested, including corrosive soil, acid water, aggressive flux, and sloppy installation. Corrosion in buried pipes is usually blamed on the soil. Marc Edwards, an associate professor of civil engineering at Virginia Tech, has been studying copper pitting corrosion for years. He says, "In the soil environment, the number of possible causes of corrosion are infinite: galvanic, microbial; it could be conductivity, alkalinity, phosphorous, or organic content."

Water chemistry. Copper tubing can also develop pinholes without being in contact with the soil. This internal corrosion is usually blamed on "aggressive" water, although there is no clear understanding of what makes water aggressive. Repiping specialist Gage says that the most important factors in making water aggressive are low pH and high levels of dissolved carbon dioxide and oxygen. A pH value lower than 7.0 is considered acidic, while higher pH values are alkaline. Acid water is known to be corrosive; in fact, ANSI/NSF Standard 61 certifies copper for use only where the pH of the water is 6.5 or higher. Although highly alkaline water can also be corrosive, such water is so unpalatable it is rarely used as a water source.

Installer error and the wrong flux. Andy Kireta, vice president of tube, pipe, and fittings for the Copper Development Association, agrees that some soils are aggressive. He alleges that some corrosion in buried copper might be caused by changes in soil chemistry from agricultural runoff or from ashes of burnt construction debris.

When it comes to internal copper corrosion, however, the copper industry tends to emphasize installer error as a factor in copper pitting. Kireta asserts that some pitting is caused by inadequate de-burring of cut tubing, which can reduce pipe diameter and increase water velocity. Allegedly, this can lead to excessive internal wear and eventual tubing failure, especially near fittings.

Kireta also blames some cases of pitting on standard formulations of soldering flux, which are not as "flushable" as recently introduced fluxes meeting ASTM B-813.

It's still a mystery. Virginia Tech researcher Edwards says there is no experimental data supporting the theory that aggressive flux causes pinholes. "It's just anecdotal evidence," he says. Edwards believes that internal pitting is associated with water that is acidic and high in sulfates, but even these factors don't fully explain the mystery. "I say this as someone who has studied this problem for a long time: I don't have a clue what causes this problem," says Edwards. "We know that sometimes brand new copper pipe is installed in a house, and a hole is eaten through that pipe in as little as one month. No one has been able to come up with a set of circumstances in a laboratory where a hole can be eaten through in a year, much less a month. If we can't reproduce this, we don't understand it."

What Can a Builder Do?

In areas that have been plagued by copper pitting problems, many builders have switched to plastic pipe if allowed by code. Yet copper remains the pipe of choice in most parts of the country. Marc Edwards advises that builders can minimize the chance of having copper corrosion problems by not using an excessive amount of flux, by flushing the pipe properly — for ten minutes at full bore — after installation, and by not allowing pipes to sit idle for a long period of time before they are brought into regular use.

PVC *Chic*

Two New York City designers, Constantin Boym and Laurene Boym, have designed a series of flower vases made of 3-inch PVC pipe. Ms. Boym says that she was inspired to design the vases when walking down the plumbing aisle of Home Depot.

The vases sell for $28 each at a New York boutique called Moss. "They're a phenomenal bestseller," says Boym. "It's because of the beauty of the material. It forces people to look at an everyday object in a new way, as a sculpture. You know, usually these pipes hold water, but now they hold flowers."

Moldy Basements

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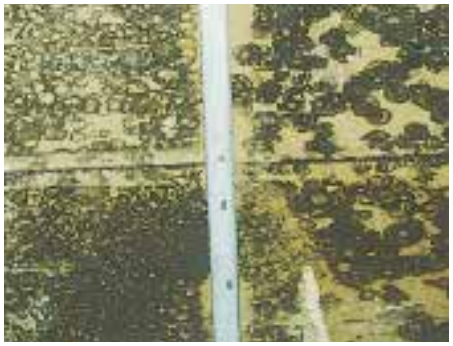
Moldy houses are unhealthy. Although there is disagreement on the cause of the Cleveland deaths, experts agree that moldy houses are unhealthy. "Mold in houses is not a good thing," says Dr. Burge. "It could lead to asthma. Houses with mold are damp, and have dust mites and other things in them that can cause illness, especially in children."

Although indoor air quality problems are often associated with tight houses, the Cleveland cases occurred in older, leaky homes.



Stachybotrys is a toxic black mold that can grow on damp drywall. Some experts believe that 16 infants in Cleveland died after inhaling stachybotrys spores.

Don Fugler, a building science researcher at the Canada Housing and Mortgage Corporation, studied 400 houses chosen at random in Ottawa. "We found that 50% of the basements had evidence of moisture damage at some time," said Fugler. "Wherever you had chronic wetting, you had mold. Wherever you had mold, you had at least one toxigenic mold."

Basements should be dry. Keeping basements dry is the best way to keep down mold growth. "I'm not nearly as interested in trying to identify the vector of the illness by genus and species as I am in exploring more deeply how to make wet basements or crawlspaces dry," says Bill Rose, a research architect at the University of Illinois in Urbana. In fact, developing low-cost strategies to dry out wet basements and crawlspaces will be the focus of a three-year, $3.9 million HUD grant for Cleveland and Chicago. The money will be spent on research, as well as on remediating mold problems in low-income homes. Rose believes that "the most important thing is to ensure that rainwater discharge is dumped onto surfaces that are sloped away from the building."

Fugler agrees on the importance of keeping basements dry. "If you have a basement with any sort of wetting, be it leakage or flooding or a high water table, then don't finish the basement unless you take care of the moisture problem first," says Fugler. Ideally, the problem is addressed when a home is built, before the foundation is backfilled. "The best way to keep basements warm and dry is to keep the insulation and drainage on the outside of the foundation," says Fugler.

Worker safety. If a building is moldy, even brief contact can cause illness. Berlin Nelson, a professor of plant pathology at North Dakota State University, says, "If you're a remodeler fixing a problem in a home — any kind of water damage, a high water table, a roof leak, or plumbing leak — you've got to be careful. Look closely for evidence of mold growth on the materials. There are several types of toxic fungi that can grow on materials, not just stachybotrys. You need to wear gloves and an OSHA-approved respirator, not just a dust mask."

More information on stachybotrys mold can be found at www.scisoc.org/feature/stachybotrys.

Taking Care of NiCads

The chemistry of nickel-cadmium batteries has changed over the last few years, and so has charging technology. Back in the old days, we were told to run batteries completely flat before recharging them so they didn't acquire a "memory."

This advice is the job-site equivalent of an urban myth. It sounds plausible, but it's just not true anymore. Each time you do this, in fact, you're decreasing the potential life of the battery. Every major battery and tool manufacturer now recommends that for the best service life, you should recharge the battery as soon as you notice a decrease in tool performance.

NiCad batteries don't have a memory. In fact, more frequent charging will increase their useful life.

Another practice worth changing is the habit of throwing old batteries in the dumpster. Improper disposal of cadmium can have serious environmental consequences, so recycling NiCads is especially important. Most major manufacturers are members of the Rechargeable Battery Recycling Corporation, a nonprofit organization dedicated to the recycling of rechargeable NiCad batteries. It shouldn't cost you anything to recycle your used batteries, and in most areas it is now illegal to dispose of NiCad batteries by any means other than recycling. You can get more information on battery recycling at 800/822-8831, or www.rbrc.org.

Stucco By Any Other Name

For at least the last eight years, some builders in Sarasota County, Fla., have been describing their stucco by another name, such as "decorative cement coating" or "smooth deco finish." They hoped that using these terms would exempt them from code requirements that call for a minimum thickness of 7/8 inch for stucco.

Jerry Sparks, chief building official for Sarasota County, doesn't buy it. "It's pretty clear in my mind what the definition of stucco is," he says. "According to ASTM C 926, section 3.2.23, stucco is a Portland-cement based plaster used on exterior locations. We asked the builders what 'decorative cement coating' was, and it was explained the same as you might describe stucco."

To clarify the issue, Sparks's permit office released a memo on August 24, 1999, ruling that decorative cement coating is the same as stucco, and therefore must comply with ASTM C 926.

Some Florida builders called their stucco "decorative cement coating," allegedly to avoid code requirements for stucco.

Builder Won't Sell to Lawyers

Builder Donavan Judkins, president of Burlington Homes in Bakersfield, Calif., doesn't particularly want a lawyer for a client, reportedly because he feels that lawyers are too litigious. However, his approach to avoiding legal hassles seems to have backfired. When he discovered that Timothy Liebaert — who had just submitted a check for $3,000 as a deposit on a Burlington Homes lot — was a lawyer, he returned the check to Liebaert the next day, marked "void." Guess what happened next? Attorney Liebaert sued.

Liebaert, 32, an environmental lawyer, hoped to buy a $145,900 house for himself, his wife, and his two children. After Burlington Homes refused to sell him a lot or build him a home, he went to court, alleging civil rights violations. The trial court dismissed the discrimination claims, ruling that developers can legally refuse to sell houses to lawyers, as long as the refusal is made for business reasons. Liebaert has since revised his suit, claiming that Burlington Homes discriminated against his wife because she is married to a lawyer. A trial date has not yet been set for the revised suit.

"They made my wife cry," says Liebaert. "I feel I've been wronged."

Canada Agrees to U.S. Fee on Lumber Exports

In late August, the U.S. and Canada reached a settlement in a bitter trade dispute concerning lumber exports from British Columbia to the U.S. Canadian trade authorities agreed to a new "super" export fee of $146 per thousand board feet of lumber for any lumber exports above the historic average export level, or quota. The settlement does not affect exports from provinces in eastern Canada.

NAHB has criticized the settlement, arguing that the new export fees will lead to higher U.S. lumber prices.

Last year, U.S. loggers and mill owners were angered when Canada decided to lower the stumpage fee charged for logging on government land by 16%. U.S. critics called the lowered stumpage fees a hidden subsidy for the Canadian lumber industry.

Although U.S. loggers and mill owners are frustrated by Canadian lumber exports, these exports help keep U.S. lumber prices low.

The arbitration settlement is the latest adjustment to a five-year softwood lumber agreement signed in 1996. In late September, U.S. special trade ambassador Peter Scher outlined the U.S. intention not to renew the agreement when it expires in 2001, saying, "We believe both the governments of the United States and Canada should get out of the business of regulating lumber trade."

Builders Fly to Work on Island

With the sky-high real-estate prices on Nantucket, builders and their workers often can't afford to live there — even with the current boom in high-paying work. A commute by boat takes a few hours each way, so some builders and construction workers choose to take daily flights out of Hyannis's Barnstable Airport. "Construction workers are our bread and butter," says Michelle Haynes, Cape Air's director of communications and marketing. "It's common to see toolboxes and lunch coolers take up storage space instead of luggage." Round-trip tickets for the 12-minute flights go for about $60.

OFFCUTS

Three Florida motorists have been impaled by rebar that bounced off the highway, according to the *New York Times*. Apparently, the poorly secured rebar fell off of trucks, creating hazards for motorists. In two cases, motorists were impaled by rebar entering the windshield, and in the third case, a short length of rebar bounced through the floorboard of a car and stabbed a driver in his leg. None of the injuries were fatal. The trucks that lost the rebar remain unidentified.

Hazardous fiberglass ladders have been recalled because of short, poorly secured steps. The ladders, manufactured by Louisville Ladder, have the Ridgid brand name, and were all sold at Home Depot in June and July 1999. Call 888/318-7911 or visit www.ridgidladder.com/notice.htm for more information.

Homeowners can't sue builders for emotional distress, according to a ruling by the California Supreme Court. The Aug. 23 opinion, which was praised by many builders, ruled that contractors, even if they are negligent, are not responsible for the mental health of homeowners.

Unsafe GFCI receptacles with a counterfeit UL stamp have been sold in Florida and some other states. The receptacles can be identified by looking for the "KIC" company name and the catalog number "KGI11" on the outer box that came with each outlet. According to Underwriters Laboratory, the receptacles fail to interrupt the supply of power in the presence of a ground fault.

Boom Truck for Backfill

A Canadian company has developed a truck that not only can haul stone from the gravel pit to your job site — it can even place it exactly where you want it.

The equipment, called the Stone Slinger, is made by W. K. Dahms Manufacturing in Ontario, and can be mounted on any heavy-duty truck chassis. The Stone Slinger can haul up to 20 tons, and is loaded at a quarry like a conventional dump truck. When it gets to the job site, a swiveling 17-foot boom is deployed off the back of the truck to deliver the stone.

"The boom has an adjustable-speed conveyor belt," says Jason Neale, owner of a Woodbine, Md., company called Stone Shooters, which has three of the trucks. "At the fastest speed, the stone shoots away from the boom. We can place the stone up to 60 feet away from the truck."

This truck is equipped with an adjustable speed conveyor that can place crushed stone precisely where it is needed.

Most of Stone Shooters' customers are concrete contractors who need to place 3/4-inch crushed stone around the drain tile of residential foundations. "A typical house might use about 40 tons of stone," says Neale. "The cost for that much stone, including delivery and placement, would be about $640 to $680, depending on the distance traveled." The equipment is also used by landscapers to place topsoil, and by excavators to place stone or sand for septic systems.

"Contractors like it because you don't need a whole crew, and you don't need a Bobcat," says Neale. According to Dan Colwell, a distributor for the equipment, "It can do about six hours of labor in 15 minutes."

British Drywall Supplies U.S. Demand

Because of the U.S. shortage in gypsum wallboard, all three British drywall producers — British Plasterboard, Knauf, and Lafarge Plasterboard — have begun exporting to the U.S.

Gypsum wallboard is bulky and heavy, but the drywall shortage has raised U.S. prices to the point where it is now worthwhile for British producers to pay the high shipping costs. Lafarge shipped more than 10 million square feet of British drywall here in 1999. "We've been shipping in very large consignments," says Kieran Hehir, Sales and Marketing Director of Lafarge Plasterboard in Bristol, England. "We've sent over 3 or 4 ships pretty well filled."

Since British drywall is normally made to metric dimensions of 1200 x 2400 mm — the equivalent of about 47 1/4 x 94 1/2 inches — the drywall destined for the U.S. had to be specially made. "To produce it," said Hehir, "we had to buy some extra-width paper."

Rising prices for drywall in the U.S. have attracted the attention of British drywall manufacturers, who have begun exporting to this country for the first time.

The British plant shipped the drywall to Lafarge Corp., its sister company in the U.S. Ted Pile, vice president for communications at Lafarge in Reston, Virginia, says, "At our U.S. production plants, we've been operating 24/7, and we haven't had enough to go around. But it should get better over the next couple of years."