Repairing Fire Damage

by Fernando Pages Ruiz

Spotting clouds of black smoke rolling over the treetops, I drove into the neighborhood slowly, fearing the worst. There was the little house I had just built for an elderly couple, girdled by firefighters armed with hoses while the roof blazed and crackled furiously. "If they're inside," I thought, "they could be dead." But through the smoke, I recognized the owners, unharmed, talking to the police. A bad connection in the couple's dryer had leaked gas and exploded like a grenade. Fortunately, nobody was home.

Assessing the damage and making repairs is challenging enough, but you've also got to get rid of that smell

The next day, they phoned: "Can you help us rebuild?" My first thought was to say no, thinking it would be easier to tear down and start over again. But the insurance adjuster wouldn't hear of it, insisting the house could be fixed. Thanks to his patience and advice, two months later my customers moved back into their fully restored home.

That was nearly 20 years ago. Since then, I've rebuilt dozens of homes badly damaged or nearly destroyed by fire. And while I started out with virtually no experience in fire restoration, now it represents a sizeable portion of my business.

In my area, only a handful of contractors seem to be willing to put up with this messy, hazardous, and very specialized work, so competition isn't too stiff. A willing remodeler can tackle a fire job just by learning a few basic steps, acquiring several new tools, and learning to think like a structural paramedic. After all, the work has its advantages: Bad weather and weak economic cycles have little impact on restoration work. Payment comes from insurance companies, so it's reliable. And if you do a good job, it's easy to get repeat business; one adjuster can hire you time and again.

Securing the Site

Since nobody plans for a fire, restoration jobs come ad hoc, sometimes on Sunday, often in the middle of the night. Usually an adjuster or insurance agent calls with an address and a general description of the disaster. By the time I arrive, the fire department has done its job; my part involves first making a preliminary damage

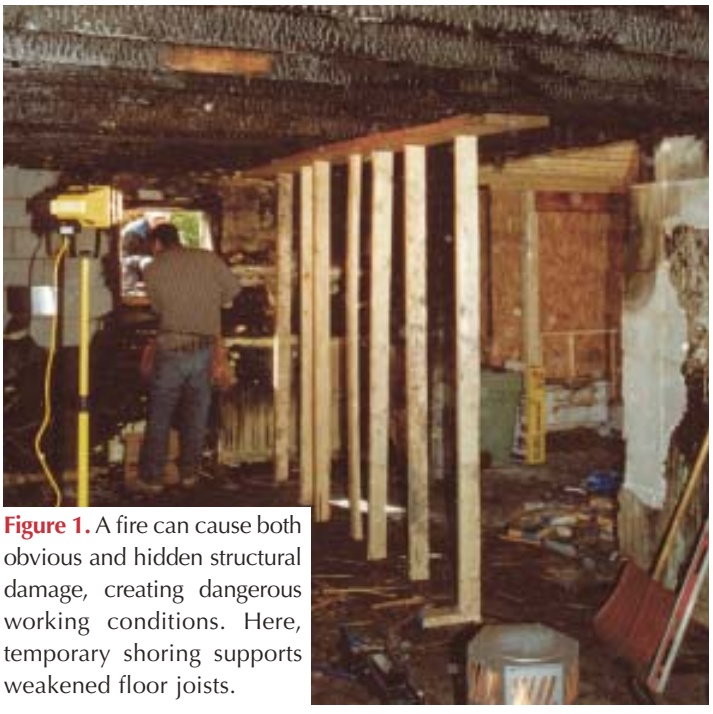


Figure 1. A fire can cause both obvious and hidden structural damage, creating dangerous working conditions. Here, temporary shoring supports weakened floor joists.

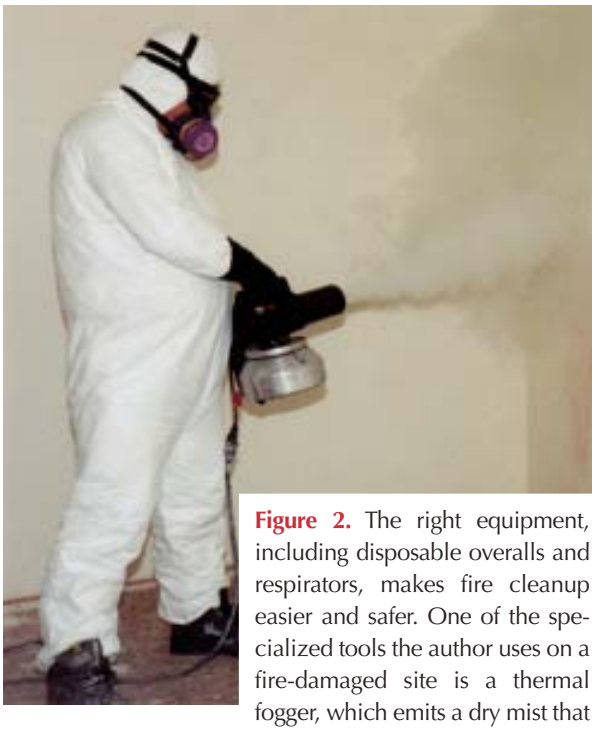


Figure 2. The right equipment, including disposable overalls and respirators, makes fire cleanup easier and safer. One of the specialized tools the author uses on a fire-damaged site is a thermal fogger, which emits a dry mist that helps to neutralize smoke odors.

Figure 3. Anything that gets tossed in the dumpster is photographed, while salvageable personal effects are carefully cleaned and deodorized before being stored in a clean storage facility (above). Clothes stored there are deodorized with an ozone generator, which helps eliminate lingering smoke odors caused by burning wood (right).

assessment and then securing the building.

Since I have to be ready to roll whenever the call comes, I keep some basic gear in my truck, including gloves, a dust mask, a flashlight, a pry bar, and a folding ladder. I wear thick-soled boots to protect my feet from broken glass and other sharp wreckage, and stock disposable coveralls in the cab to shield my clothing from soot stains and smoke odors. Sometimes I rub Vaseline on my face and hands so I can wash off the stench without having to remove a layer of skin.

As soon as I arrive at the job site, I walk around the building to assess structural damage. I look for broken windows and doors, holes in the exterior walls, and damage to the roof. If I find any of these conditions, I radio my employees. A specialized board-up crew installs 1/2-inch plywood and reinforced polyethylene sheets wherever rain, wind, or mischief-makers could get in.

I check the utilities, too. Though the fire department usually contacts the electric, gas, and water companies to disconnect their services, I have discovered downed power lines, leaking gas

pipes, open water mains, and other hazards requiring immediate attention.

Once I've determined that the perimeter is secure and the building appears safe to enter, I try to find access into the basement. This allows me to inspect the floor joists and stairs from below. Fire travels up, so it's sometimes necessary to shore up a few joists before it's safe to walk around (see Figure 1, page 2).

Because there's usually no power on the site, members of my crew carry battery-powered tools, flashlights, kerosene heaters, and a portable generator. To keep the workers safe, I supply them with hard-hats, respirators, disposable coveralls, heavy-duty gloves, and safety glasses, and I insist they wear heavy-soled steel-toe boots and sturdy work clothes with long pant legs and long sleeves (Figure 2, page 2). Their first job is to secure the building, eliminate dangerous conditions, and drain plumbing lines. Sometimes they'll mop floors and pump out standing water. If I suspect that hazardous materials are present, such as lead paint or asbestos, I hire qualified technicians to test for them and, if necessary, remove them before we proceed further.

Demolition and Salvage

Like any remodeling project, the first step in fire reconstruction involves selective demolition. But in a fire job, this becomes a salvage operation, too. We start out by sorting through rooms full of charred furniture and personal effects to make sure we rescue sentimental items — perhaps a wedding ring, a family portrait, or a beloved teddy bear. We work slowly, cutting and removing damaged doors, wall coverings, and carpets without injuring adjacent surfaces. It typically takes several days and dumpster loads before the job starts to resemble a more normal renovation project.

Fires frequently do more damage to the contents of a house than to the structure, so a big part of our job involves separating salvageable personal effects and moving them to a secure, dry location for cleaning and inventory. We also have to throw away items damaged beyond repair. To help the homeowners inventory the items we discard, I provide all of my employees with disposable cameras. They make notes and take photographs of every item we discard (Figure 3, page 2).

Restoring personal effects. In our warehouse facility, we have an enclosed room equipped with an

Figure 4. Heat and smoke can travel along joist bays and melt electrical wiring without causing obvious structural damage. Removing drywall is the only way to accurately trace a fire's path and assess the damage.

Figure 5. Though framing may be charred on the surface, joists (above) and studs (left) can still be structurally sound. Paring down to solid wood helps the author determine if joists and studs meet code-specified notching guidelines, or if they need replacement.

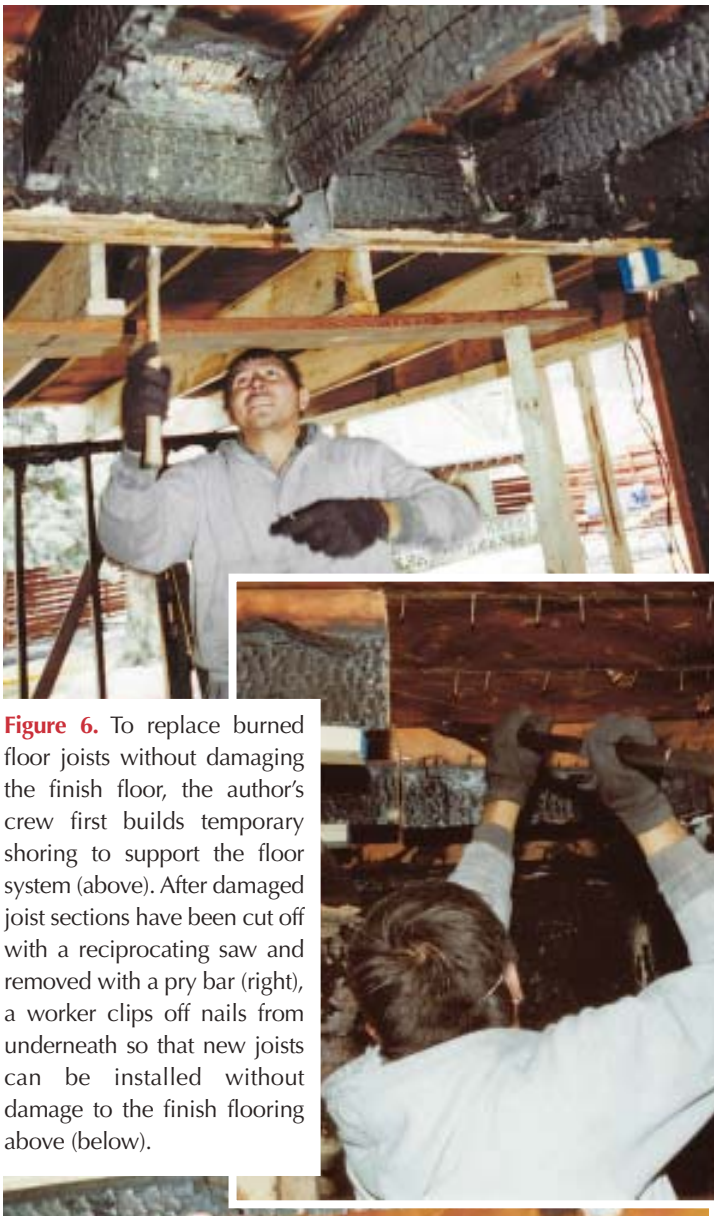


Figure 6. To replace burned floor joists without damaging the finish floor, the author's crew first builds temporary shoring to support the floor system (above). After damaged joist sections have been cut off with a reciprocating saw and removed with a pry bar (right), a worker clips off nails from underneath so that new joists can be installed without damage to the finish flooring above (below).

ozone generator to deodorize every restorable item. In a separate area, workers clean furniture, bric-a-brac, and appliances. Important papers are deodorized, wiped with dry chemical sponges, and stored in file boxes. I take bedspreads, clothing, stuffed animals, and linens to a dry cleaner that specializes in smoke-damaged fabrics. Singed photographs go to a studio where workers scan the images to re-create family portraits. By the time we're done, the owner's personal effects are often cleaner and better organized than they were before the fire. To keep track of everything, I provide my move-out crew with a simple, color-coded floor plan and corresponding colored tags to attach to every item, room by room.

Dealing with water damage. Water from firefighting efforts and melted pipes can damage a structure even more than the flames did. If there's major water damage, I'll hire a specialty subcontractor to dry out the building. But by using fans and an industrial-strength whole-house dehumidifier, we generally can bring humidity levels down to normal levels. If the air-conditioning system is functional, we can also run that to help dehumidify the building. One thing we *don't* do is turn on the heat, which only helps create a petri dish–like environment that breeds mold and mildew.

In winter, plumbing can ice up right after a fire. To prevent this, a cup of antifreeze in each toilet and a splash of it into p-traps can save thousands of dollars in fixture and pipe replacement.

Repairing Structural Damage

The extent of structural damage depends on how hot the fire was and how long it burned. Structural steel, masonry, and sheet metal expand and weaken in the presence of heat. It's not unusual for steel headers and beams to collapse. Roof trusses dry out and shrink when exposed to intense heat. Even if they haven't caught fire, this shrinkage can loosen truss plates and weaken the roof structure.

You can't accurately assess structural damage without first mapping the exact route the fire could have taken. Flames can race up between studs and destroy a portion of the roof while leaving the walls apparently intact. Floor joists can burn to the point of failure while hidden behind a drywalled ceiling. And even when a fire isn't hot enough to burn through wood framing, it's still possible for wire sheathing and flexible ducts to have melted in joist and stud bays. So, in order to determine if flames went up through balloon framing, into chases, and across drop ceilings, I try to make a visual inspection of the entire fire path,

even if this requires removing drywall. I crawl into the attic, climb onto the roof, and peer down the chimney (Figure 4, page 3).

When the framing is charred, I try to determine how deeply the fire has burned through it. As a guide, I refer to the Uniform Building Code's notching standards for structural members. Charring at the top or bottom of a joist, for example, shouldn't exceed one-sixth the depth of the joist. Load-bearing studs can't be charred more than one-fourth their width. My rule of thumb is that any damaged framing that falls within these limits can stay, requiring only cleaning and bracing; framing burned beyond these limits gets replaced (Figure 5, page 3).

Some structural systems can fail even when wood members haven't burned at all. The metal clips that hold an engineered truss together can loosen with even moderate heat, dangerously weakening the entire structure. If I have questions, especially on roof trusses or engineered floor systems, I don't hesitate to get advice from my building inspector or a structural engineer.

Because we try to preserve as much of the existing structure as possible, we often work backward, replacing joists without removing the subfloor, swapping burned rafters without tearing off the roof sheathing, and sometimes even replacing an entire exterior wall frame without demolishing the exterior brick veneer (Figure 6, previous page). Because this can be painstaking, I prefer to do all the structural work with my own employees. Demolition, cleaning, and framing occur simultaneously in fire restoration, not in the separate stages subcontractors are used to.

Getting Rid of the Smoke

Smoke penetrates walls and ceilings, so that every surface, even those exposed through demolition, must eventually be cleaned, deodorized, and sealed with special tools and chemicals. Even a small tuft of smoke-saturated insulation left behind can present a major problem when the customer calls to say, "Our house still smells like smoke." To avoid that, we use a small battery of contraptions and a sizable array of chemicals to deodorize and clean every crack and cranny in a house (Figure 7).

Ozone generator. One of the first tools deployed on the job is our Sonozaire 115A ozone generator ($815, Howe-Baker Engineers, 800/323-2115, www.sonozaire.com) along with a large fan. The ozone generator (Figure 8) plugs into a standard outlet and electronically produces a stream of ozone-enriched air that oxidizes odor-causing molecules and converts them into odorless CO_2. The fan helps spread this ozone-enriched air throughout the house. Since high

Figure 7. To control smoke odor, the author uses chemicals specifically formulated for cleaning and deodorizing. Some are simply applied by mop or brush, while others require specialized equipment, such as the thermal fogger (shown at left in photo) and wet fogger (shown at right).

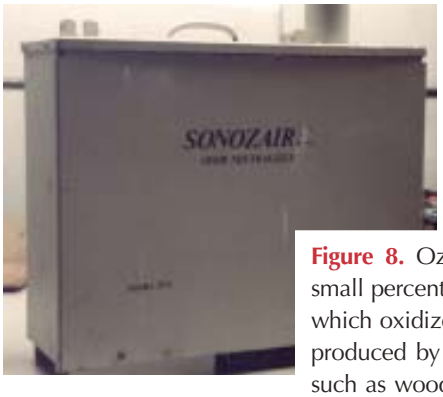


Figure 8. Ozone generators convert a small percentage of oxygen into ozone, which oxidizes odor-causing molecules produced by burning organic material, such as wood or paper. This model (by Sonozaire) weighs about 32 pounds and can treat 2,500 to 15,000 cubic feet.

Figure 9. A thermal fogger uses a heating element to produce a dry mist of either water- or solvent-based scented deodorant. Starting at the point of origin, a worker follows the fire's path with the dry fogger, making sure to treat every room.

Figure 10. To attack odor-causing particles hidden in wall and ceiling cavities, the author uses a wet fogger to spray a combination of deodorants and sealers through holes punched into the drywall (right). A wet fogger can also be used to deodorize and seal smoky ductwork, though cleaning the ducts properly requires specialized duct brushes and vacuums, a process the author subcontracts (above).

ozone levels can harm people, we use it only in empty buildings and generally overnight, when no one's working.

Dry fogger. Ozone works best on organic (wood, paper, and protein) odors, but because house fires consume many different materials, just one deodorizing system won't work. After the house has been sealed up and all the smoked debris and wood framing have been replaced, I deploy a thermal fogger called the Electro-Gen 2000 ($200, Unsmoke Systems, 800/332-6037, www.unsmoke.com).

A thermal — or "dry" — fogger resembles a low-volume lacquer sprayer that combines a heating element with a small pump. Once the element heats up, the fogger produces a fine, dry, odor-neutralizing mist that can trace the pathways of smoke and reach areas unreachable by other tools. We pour a cherry-scented, solvent-based deodorant, Thermal Fog CD27GLA (Bridgepoint Systems, 800/794-7425, www.bridgeport.com), into the reservoir, though water-based deodorants are also effective. I like to start in the same spot as the fire began and then follow the fire's path through the house, fogging every room (Figure 9, previous page).

Wet fogger. To sanitize between concealed stud bays and ceiling joists, I puncture the drywall and insert a spray hose attached to my PureMist ULV wet fogger ($285, available from Bridgepoint Systems). This tool resembles an airless paint sprayer and atomizes powerful, water-based deodorants and sealers. I like to use Unsmoke's 9-D-9 Deodorizer and Bridgepoint Systems' Smoke Odor Counteractant CD24GL, because they inhibit the evaporation of odor-causing gases (Figure 10).

After saturation-fogging behind drywall and into concealed areas, I seal off any remaining odor-causing particles with a water-based sealer, Bridgepoint Systems' Soot Sealer CD25GL. I blend this sealer with additional additives — for example, Deodorizing Additive CD28QT and Smoke Odor Counteractant CD24GL,

Figure 11. A simple pump-sprayer is an effective way to saturate smoke-damaged areas with detergents, solvents, and deodorants (above). To help eliminate smoky odors, these exposed and charred — but structurally sound — joists are given a final scrubbing (right).

Figure 12. Because heat causes paints to become porous, household cleansers tend to smear rather than remove dirt; specialty cleansers that combine solvents and detergents are more effective and can also be fortified with odor-fighting additives. A pump-sprayer is an effective way to apply the cleaner (above), but sometimes there is no substitute for elbow grease (right). After cleaning, spraying a soot sealer on the walls with an airless paint sprayer locks in any residual odors before the walls are primed and repainted (below).

both from Bridgepoint Systems — for a greater margin of security against untreated odor. I use a similar procedure for sealing ductwork, although I usually hire out the duct cleaning because it requires specialized brushes and vacuums that I don't own.

Cleaning Is a Specialized Process

Unfortunately, there's no single super-cleaner that removes every kind of smoke damage from every surface. But there are a number of high-tech cleaning products that can save thousands of dollars in replacement costs. In fact, cleaning has evolved into a complex craft with specialized products ranging from delicate enzymes that eat proteins to powerful soot-dissolving acids. For instance, we use dry chemical sponges to extract soot from wallpaper and other delicate materials that cannot take water. To clean textured ceilings, we use a chemical-bleach mist.

Elbow grease works best on most exposed surfaces. I scrub with a variety of industrial cleaners, depending on the nature of the fire. For all-around cleanup, I like Bridgepoint's Hard Power CC31GL, a versatile blend of detergents and solvents. Some areas are more difficult to wash, like exposed framing, so I combine Hard Power with one or more various manufacturer-recommended additives, using a pump-sprayer to saturate smoke-damaged areas (Figure 11, page 6).

Before any framing gets buried under insulation and drywall, I lock down the last traces of odor with a water-based soot sealer. This final application of soot sealer can be put on with a wet fogger, though I prefer to use an airless paint sprayer because its high-volume output makes fast work of large areas.

The airless sprayer works well for sealing wall surfaces, too. But don't make the mistake of using a shellac-based sealer like Kilz (Masterchem Industries, 800/325-3552, www.kilz.com) to seal in smoke odors. These sealers are really effective only against stains, so it's best to lock down smoke odors with a clear, odor-inhibiting soot sealer, and then apply a tinted shellac-based stain block as a primer (Figure 12).

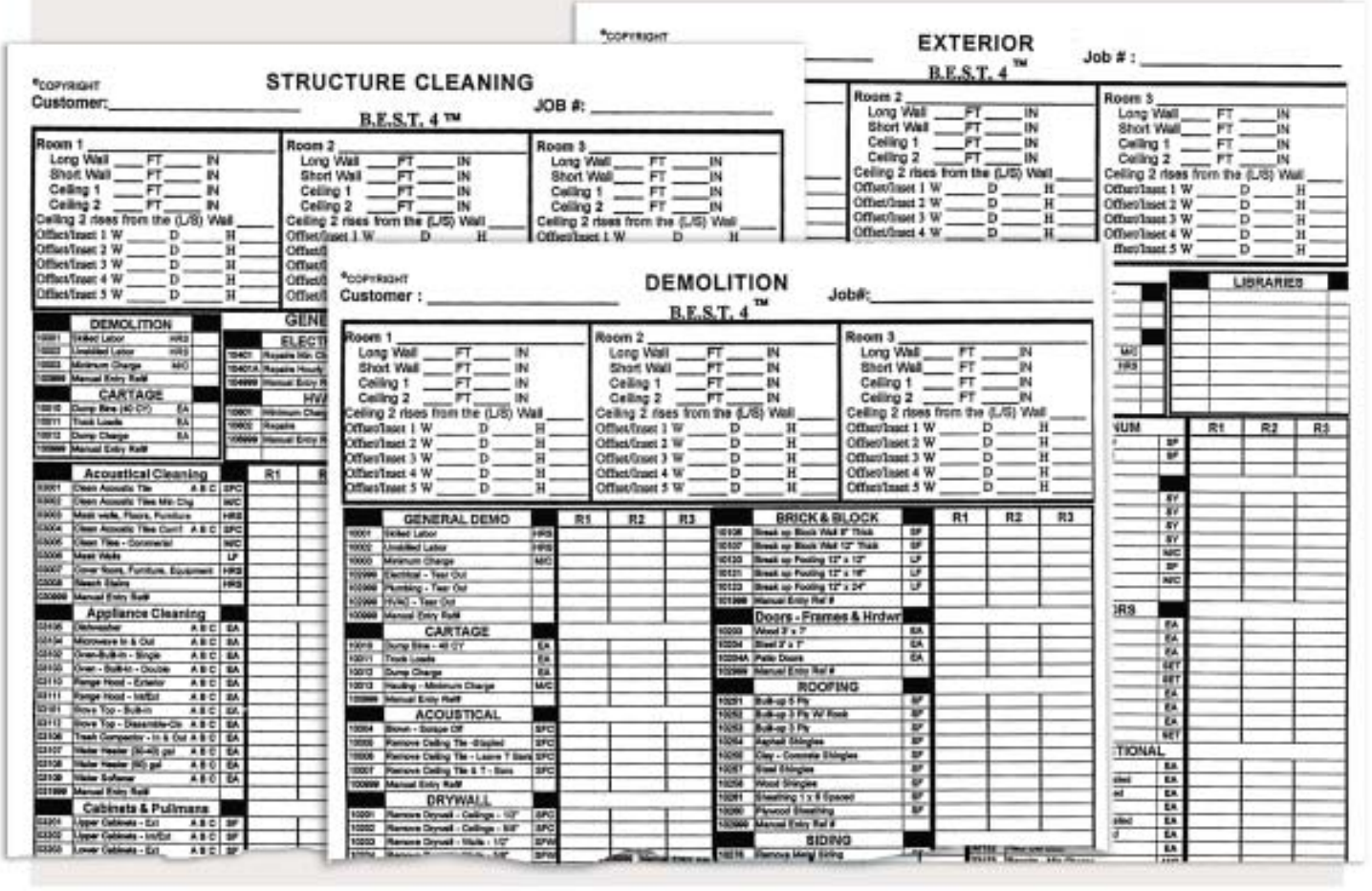
Because cleaning can be complex, many general contractors occupy themselves with just the structural portion of the job and leave the cleaning to the experts. I subbed out the cleaning for several years before attending training and certification courses

Pricing Fire Damage

To make the process of assessing and pricing a large fire-restoration project faster and easier, I store my estimating gear in a handy toolbelt with loops and pouches for everything from my tape measure to my camera. As I walk through the house, I draw a sketch of the floor plan, labeling each room and noting dimensions. Then I walk through again, this time with a pad of preprinted estimating sheets on which I check off, in detail, all the work that needs to be done, room by room. I make a final trip through the entire house taking pictures.

Back in the office, with my sketches, checklists, and photographs in hand, I prepare a detailed cost estimate using insurance-industry pricing standards developed by the *Bluebook Residential & Light Commercial Cost Guide for Cleaning, Reconstruction & Repair* ($89.95, written by Daniel E. Josipovich, 888/425-8326, www.bluebook.net). I especially like Bluebook's excellent — but pricey — estimating program: B.E.S.T 7 ($2,500 list, but generally discounted to $1,600). This program formats the estimate to insurance-industry standards and makes it easy to detail hundreds of lines of unit pricing.

Unlike a conventional construction estimate, in which broad categories — such as framing, drywall, and paint — are used to catalog and price the job, a restoration estimate describes the work item by item and area by area. Each item represents a specific task — remove drywall, install drywall, paint drywall, and so on — while each area represents a work site — a bedroom, say, or a stairwell or backyard. This format helps the insurance adjuster review the estimate more easily. It also helps me produce a more thorough valuation, with no guesstimating involved. — *F.P.R.*



offered by the Institute of Inspection, Cleaning, and Restoration Certification (www.iicrc.org). You can also become more familiar with the techniques, products, and tools available for restoring fire-damaged surfaces by visiting a professional cleaning-supply company.

Before moving on to reconstruction, I like to sprinkle super-absorbent odor crystals or lay larger, spongelike odor blocks between stud bays, chases, and anywhere else smells can hide and fester. This provides another layer of "whiff" protection. If all these apparently redundant procedures seem like overkill, well, that's the whole point.

By the time the electricians, plumbers, and mechanics arrive, our jobs resemble a normal remodeling project. And instead of acrid smoke, the job sites smell like candy.

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