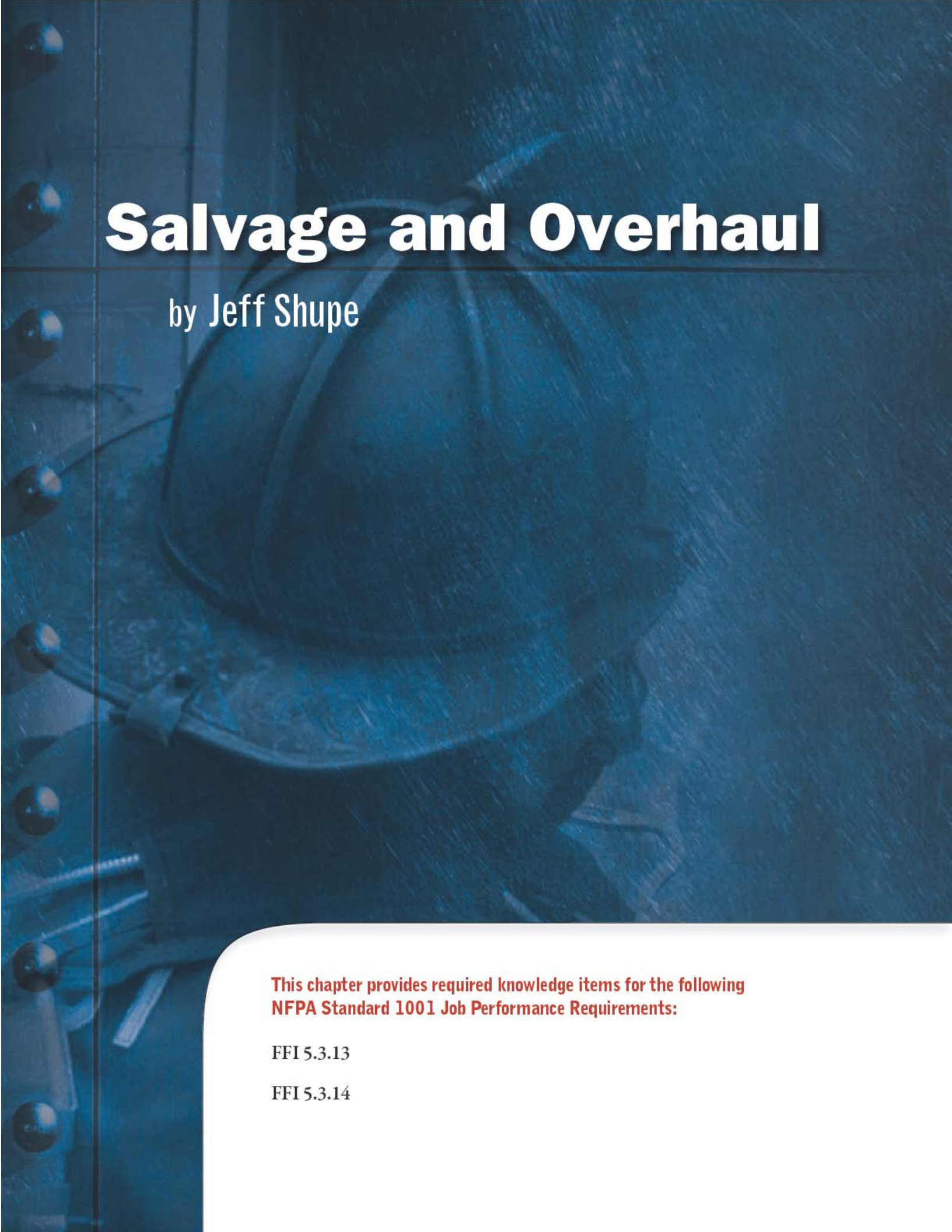

Salvage and Overhaul

by Jeff Shupe

This chapter provides required knowledge items for the following NFPA Standard 1001 Job Performance Requirements:

FFI 5.3.13

FFI 5.3.14

This chapter contains Skill Drills. When you see this icon, refer to your Skill Drill book for step-by-step instructions.

OBJECTIVES

Upon completion of this chapter, you should be able to do the following:

- Define the term *salvage*
- Identify types of damage done by fire
- List the tools and equipment needed to effectively perform salvage operations
- Describe methods of grouping furniture in order to protect them from damage
- Describe two methods of deploying salvage covers
- Describe two methods of storing salvage covers
- Identify two methods of removing standing water from a structure
- Identify two methods of stopping water flow from an activated automatic sprinkler system
- Describe different methods of securing a building after firefighting operations
- Define the term overhaul
- List the equipment needed to effectively perform overhaul operations
- List four ways of detecting hidden fires
- Describe two devices that are used to detect hidden fires
- Identify methods for opening walls, floors, and ceilings
- Identify techniques for overhauling roofs and building contents
- Describe overhaul's role in conducting a fire investigation

INTRODUCTION

Salvage can be defined simply as "the art of saving property." It is a process whereby firefighters try to minimize damage to a structure and its contents when a fire or other emergency takes place. During firefighting operations, the basic way to save anything from harm is to either extinguish the fire and stop its destruction, or remove items of value from affected areas. This effort helps fire departments keep property loss down and achieve the stated goals of the American fire service, which are to save lives *and* property.

Sometimes known as **loss control**, salvage is a component of firefighting that can go a long way toward building good public relations between a fire department and the community it serves. Many fire departments have received praise and accolades for jobs well done at saving someone's property from fire. Some fire departments have even benefited from this financially and in other ways. Even though firefighters learn the importance and value of good salvage techniques early in their careers, it is one of the things that probably receives the least amount of attention on the fireground until after the bulk of the fire has been knocked down. This lack of attention may be partly because it is not truly associated with the excitement of actual fire-suppression efforts or other closely related *action* work at a fire. However, it is truly gratifying when someone acknowledges that you have done a commendable job of saving someone's property from loss.

KINDS OF FIRE DAMAGE

Generally, there are two classifications of fire damage: **Direct** (or primary) and **indirect** (or secondary). Direct fire damage is that which is caused by the actual combustion process, where there is physical destruction from flame, heat, or smoke. Indirect damage is all other damage caused from suppression efforts and other activities. An example of indirect damage is opening up of ceilings and walls to check for fire travel. There may not be any fire, but the job must be done, because if overhaul is not done and fire is left unchecked, the results will show later with more damage and the need for more overhaul.

SALVAGE OPERATIONS AND PROPERTY PROTECTION

FFI 5.3.14 **Salvage** is one of three incident priorities of firefighting. It falls under the heading of *property* conservation. It is also considered one of the basic steps of firefighting. With these points in mind, the importance of saving what we can or what we must save cannot be overstated.

Salvage begins with fire attack. It can take place in many forms, ranging from suppression efforts to the actual removal of property or the grouping and covering of property from threat of damage. An example of salvage from suppression action takes place when firefighters make a quick, aggressive knockdown of a fire followed by efficient ventilation to rid the building of heat, smoke, and gases. The size of attack, the point of approach, and the type of ventilation used in this scenario all affect the total outcome of damage. To illustrate this point, think of a working fire in the living room of an occupied two-story single-family residence. A quick and well-placed attack line, discharging the right volume of water, may be just what is needed for a rapid knockdown of a fast spreading fire while confining it to its area of origin. This effective method of attack can prevent the fire from spreading to uninvolved areas of the house, which will help to limit fire spread and damage. This effort relates to stopping direct and indirect fire damage. Quickly attacking the fire this way can stop greater loss from happening. Other fireground actions such as ventilating the building will also help the salvage effort by relieving the interior of heat, smoke, and gas accumulation.

Planning for salvage

For salvage operations to be efficient, there needs to be prior planning and training. Procedures should be developed to deal with the different kinds of salvage operations that might be needed for the different building types and occupancies found in a particular community. For example, special preplans might be needed for an office building that has especially valuable contents or documents in the offices. Preplans can tell firefighters where these contents are located and what measures should be taken to protect them.

Industrial manufacturing businesses might have materials on-site that are important to the company's survival or may require special handling or salvage techniques. Firefighting history has shown us that some small towns have existed because of their dependence on a large industry or business. Many of the town's citizens were employees of this business, and when a major fire took place, there was not enough saved to keep the operation going. The end result was jobs lost and a faltering local economy that led to scaled-back town services. That loss eventually caused a loss in the quality of life for the community. There could also be a threat to firefighter safety or a much larger problem if fire control in a particular type of facility was not protected properly and created a larger, more complex safety and salvage concern.

Sprinkler systems are a valuable asset to protecting buildings from the threat of fire. Their ability to control or hold fires until the fire department arrives has been proven over time. However, when a sprinkler system is activated, it has the ability to control a fire or hold it in check, but

after that, it has the potential to cause extreme water damage. Because of that, fire departments must know from preplans, walk-throughs, and training where sprinkler systems' riser control valves and piping are found in a structure.

Salvage tools and equipment

FFI 5.3.13 Tools and equipment used for salvage should be carried on fire apparatus in compartments where they are easily accessible. In years gone by, ladder or truck companies were generally responsible for carrying this type of equipment and taking care of salvage operations. In larger cities where there were numerous businesses requiring property protection, salvage or **fire patrol** companies were established. These were crews who were paid by insurance companies, and their only job was salvage on the fireground. The equipment carried in their apparatus was strictly for that purpose. These companies no longer exist in our cities, so all salvage operations depend solely on the efforts of the local fire departments.

Nowadays, even though certain units may carry salvage equipment, it is generally accepted that everyone has a hand in salvage operations. Many departments have some basic salvage equipment on all of their fire apparatus. Because of this, every firefighter should know where the tools and equipment are located and know how to use them.

The following is a list of tools and equipment that might be needed to perform salvage duties (fig. 21–1):

- Shovels
- Brooms
- Mops
- Squeegees
- Pike poles
- Floor runners
- Polyethylene plastic sheeting (e.g., Visqueen brand)
- Salvage covers—canvas type
- Roll roofing paper
- Buckets
- Sprinkler head kit and sprinkler tongs
- Wooden wedges of different sizes
- Submersible pumps
- Water vacuums
- Hand tools
- Hammers
- Electric or battery-operated drill
- Supply of nails and screws
- Wood lath strips
- Duct tape
- Assortment of rags and towels
- Sawdust—carried in large bags
- Debris carryall bags
- Polystyrene or wood blocks
- Linoleum or carpenter's knife

Fig. 21–1. A wide variety of equipment is used to protect property during salvage and overhaul operations.

Where and when to begin salvage operations

When beginning salvage, first determine where the initial salvage efforts will have the greatest impact on saving property. If operations start in a room below the fire floor, then you will most likely arrange or group furniture into piles. Furniture or items located below a dripping ceiling should be moved to another area of the room or removed from the area all together if necessary. Where there is a tall piece of furniture like a chest of drawers, place it in the center of the pile or group so that when a salvage cover is thrown over everything, it acts as a pole draping the salvage cover over everything while allowing water to run off and away (fig. 21–2).

Fig. 21–2. Vinyl covers protect valuable contents from hot embers and water damage. Grouping contents together allows for the most efficient use of salvage covers.

If a floor is collecting water, then it will be necessary to use blocks or even something like soup cans to lift the furniture or objects off of the floor to prevent water absorption and damage (fig. 21–3). Where fires occur in industrial or commercial occupancies, skids can be used to pile items on and lift stock items off of the floor to keep them away from water pooling.

Fig. 21–3. Sometimes simply lifting valuables up off the ground can prevent them from being damaged from water runoff.

Generally, salvage operations begin on the fire floor or the floor directly below. It is these two areas that are likely to sustain the most amount of damage from fire, smoke, heat, and water. Just after a fire is extinguished, water most likely will collect on the fire floor, then quickly find its way to areas below. If a large amount of water has been used for the fire, then operations should start directly below the fire floor as soon as possible. If the area below the fire floor has ceilings, then firefighters must check them to see if they are accumulating water and might possibly collapse. It may be necessary to puncture the ceiling to relieve built-up water in the ceiling space.

Before water is relieved, it may be necessary to figure the best way to channel water out of the area. Also, water in the ceilings may affect electric wires and fixtures. Perhaps water chutes (see later in this chapter) can be devised to get water out of the building. Floor runners may need to be placed for firefighter traffic and or water droplets falling from above.

As stated earlier, salvage operations should begin as soon as possible. They can begin immediately during a fire attack in an indirect manner or as soon as firefighters are able to initiate a more formalized effort.

Throwing salvage covers

SKILL DRILL

FFI 5.3.14 The most common salvage tool is probably the salvage cover. Typically made of canvas, salvage covers are cut or made into different sizes (fig. 21–4). Some have coatings or treatments applied to them to help shed water. Nowadays, covers vary in size, including 10 × 12, 12 × 12, 12 × 16, and 14 × 18 ft (3 × 3.7, 3.7 × 3.7, 3.7 × 5, and 4.3 × 5.5 m).

Fig. 21–4. While canvas salvage covers are found in most fire departments, they are being replaced by vinyl covers such as these.

If possible, salvage covers should be thrown over furniture piles and tucked in at the bottom of the pile to prevent water splashes from damaging the furniture.

After the salvage covers are used at fires and taken back to the fire station, the maintenance work begins. They are washed and hung up to dry. When they are completely dry and free from any chance of mold developing, they are checked for any holes or tears, then folded (fig. 21–5).

Fig. 21–5. Salvage covers must be properly folded and cleaned after each use.

A new material that is being used for salvage covers is polyethylene plastic sheeting (fig. 21–6), commonly the Visqueen brand. It has several advantages over canvas covers and tarps. One advantage is that it is economical. One roll can be 120 ft (37 m) long by 20 ft (6 m) wide. It is disposable, so there is no maintenance of cleaning, drying, and folding. It is also quick and easy to use on the scene, and it can be cut to fit the situation. The only item necessary to make it work is a utility knife or other type of cutting tool. On an apparatus, it is easy to store and can fit in any apparatus.

Fig. 21–6. Polyethylene plastic sheathing is a popular alternative to traditional salvage covers because of its low cost and the ability to manipulate its size.

Water chutes and catchalls

SKILL DRILL

Salvage covers are primarily used to protect furniture and other valuables but can also serve other uses, such as **water chutes**, where a trough is made using covers, pike poles, and ladders to catch dripping water and divert it away (fig. 21–7). Covers can also be used for holes left in the roof of a building. They can be used as catchalls after the sides have been built up or rolled up, using pike poles once again (fig. 21–8).

Fig. 21–7. Creating a water chute from a salvage cover can be necessary to divert water away from valuable belongings.

Fig. 21–8. Conventional salvage covers can have the sides rolled up to manufacture a catchall.

Removing water and dewatering equipment

Getting water out of a building is often great concern for firefighters. As you know from chapter 15, Water Supply, water weighs 8.34 lb per gal (1 kg per L). Considering that a 2½-in. (65-mm) hand line can flow upwards of 250 gpm (946 L/min), the use of such streams can add more than a ton of weight every minute to the structure. This puts an additional stress on an already compromised building. In addition, we may need to remove water from a structure to aid in a postfire investigation or to find fire victims in a flooded basement. Finally, some cities assist homeowners in pumping out basements after a flood as a public service. Whatever the reason, firefighters are often expected to use dewatering equipment in such situations.

It may be possible to remove water by clearing floor drains, if present. Additionally, it may be necessary to cut holes in floors to allow water to drain to lower levels. Toilets can be removed from their attachment to the floor in bathrooms to allow drainage as well—make sure

that the toilet is replaced or the drain is sealed after such actions (fig. 21–9).

Fig. 21–9. To facilitate draining, a toilet can be removed. This tactic can be especially important in multi-story buildings where creating chutes and catchalls isn't feasible.

Although not found too often on fire apparatus, the water vacuum is a useful device for removing water from areas that are not easily accessible with mops or squeegees. Some water vacuums are made like a backpack and are carried on a firefighter's back, making it very portable, but also limiting the amount of water it can pick up (fig. 21–10). However, if there is a large amount of water that needs to be removed and there is limited capability to do it, then the services of professional cleanup crews should be called to the scene because of their larger water vacuum machines.

The use of dewatering pumps is sometimes called for. These pumps range in capacity from a few gallons per minute to several hundred gallons per minute. Some are electric powered, while others have their own generators. Ironically, some dewatering pumps use water (hoselines) to power them. A key to the efficient use of these pumps is to select a low point location where water will flow to the pump (fig. 21–11). Ensure that the outlet of the pump is located outdoors in a location where the discharged water will not find its way back into the structure.

FFI 5.3.13 Safety is of prime importance here. Ensure that all electricity has been shut down before entering an area with standing water. Never stick your hand or any body part near any floor or roof drain; use a tool with a long handle to clear drains.

Fig. 21–10. Using a vacuum to remove water is effective at small fires or incidental discharges of sprinkler systems.

Fig. 21–11. Dewatering pumps should be placed at the lowest collection point so that the water will drain toward the pump.

Stopping water flow from a sprinkler system

SKILL DRILL

FFI 5.3.14 When ordered by the incident commander (and only the incident commander [IC]) once a fire has been extinguished, an operating sprinkler system will be shut down to avoid additional water damage. The firefighter at the riser control valve (most often an outside stem and yoke valve, or OS&Y valve) will shut off the valve (figs. 21–12 and 21–13). After closing the OS&Y valve (the stem is now completely inside the valve), the firefighter can open the main drain and drain out the water from the system (fig. 21–14).

Note: After the water is drained from the system, the sprinkler system will no longer be capable of extinguishing a subsequent fire or rekindle because the water supply will have been shut off to the sprinkler heads.

Fig. 21–12. An outside stem and yoke (OS&Y valve) in the "open" position

Fig. 21–13. An outside stem and yoke (OS&Y valve) in the "closed" position

Alternatively, a firefighter may be asked to insert a **sprinkler wedge** or wood chock into an operating sprinkler head (if it is still flowing water) (fig. 21–15). Firefighters who perform this function will get very wet—a consideration when cold temperatures would cause the firefighter's gear to freeze. The advantage of this technique is that the sprinkler system will remain in service, and the other heads that have not been activated will remain capable of extinguishing a subsequent fire or rekindle.

Fig. 21–14. The main drain of a sprinkler system is normally labeled and easy to locate.

Fig. 21–15. Sprinkler wedges or tongs come in a variety of sizes.

After a fire, most fire departments have their fire prevention bureau follow up to make sure the sprinkler system has been properly restored; some establish a **fire watch** until the system has been restored by a licensed contractor. Other fire departments actually restore sprinkler systems to full operation by replacing heads and resetting **dry-pipe valves** (the alarm valve on a dry-pipe sprinkler system in which the pipes are normally filled with air to avoid freezing) under nonfire conditions. When performing such procedures, ensure

that exactly the same sprinkler head is used to replace the head that activated.

For detailed information on total sprinkler system operations, see chapter 30, Fire Protection Systems.

Securing a building after firefighting operations including forcible entry

SKILL DRILL

FFI 5.3.14 In many fire situations, postfire salvage operations require the fire building to be secured before the fire department leaves the scene. During the course of firefighting, there might have been structural damage caused from forcible-entry work to doors and windows. Forcible entry methods for salvage can include anything from forcing doors of rooms adjacent to the fire area to cutting holes for drainage or other types of wall or floor breaches. Firefighters should try to consider the least damaging methods for forcible entry during salvage, to reduce property damage and minimize the tasks of securing the structure before leaving the scene.

If the building is one where it is going to be reoccupied after repairs, then the fire department should close any openings in the building made from firefighting or fire damage. This is to prevent any environmental damage that might occur.

For example, if the fire department had cut a hole in the roof of a house during fire operations, then it should cover the hole with a tarp or other material that will keep the elements out of the building. Generally, canvas tarps will work fine because they are heavy enough to resist wind forces and can keep the elements out also as long as they are secured to the roof. Visqueen or other plastic film sheeting can also be used; however, it may need to be double-layered to resist wind forces. The outer edges of the plastic sheeting should be folded over two or three times to give strength where it will be attached to the structure, so it won't tear from high wind forces. Also, it will be necessary to use long pieces of wood or lath strips to anchor the perimeter of the sheeting to prevent wind forces from getting under the plastic covering and tearing it off the roof decking. Another reason for attaching it this way is to stop rain or other elements from being blown underneath the covering and getting inside the building by that route.

If the roof being covered is a flat roof like that found over a commercial store or "taxpayer," it may be necessary to build a little frame with a pitch to direct the rain off the cover, so the water won't be able to collect and pool in the cover, which would cause the cover to hang down into the vent hole. Firefighters will need to figure out the best direction to pitch the runoff to.

When there has been any substantial fire damage to the first floor or lower level that will cause the building to be vacated during rebuilding, then security will be an issue. If doors or windows have been damaged from forcing, then it may be necessary to cover them with plywood sheeting or oriented strand board (OSB) (fig. 21–16). In many cases, all that is necessary to attach the sheeting is a hammer and nails and pieces of sheeting cut to the size needed to cover the window. Usually, it can be nailed to the perimeter of the window. If the building's exterior walls are of brick, then the sheeting can be attached to the top, bottom, and side rails of the window creating a now secured structure.

Fig. 21–16. Plywood can be used to secure broken windows.

If the building has sustained damage beyond repair and will need to be demolished, then firefighters will need to establish a safe perimeter with barrier tape around the property that will let people know their limits.

Floors with holes in them from cutting operations or from fire damage can be secured by simply putting a door over them and nailing it in place. In extreme cases in which much of the floor is too weak to support anyone, barrier tape over the door can serve as a warning device or nailing the entrance door shut to that area.

OVERHAUL

A simple definition of **overhaul** is "making sure the fire is out and leaving the building in as serviceable a condition as possible." Overhaul is a learned process that is extremely important to the outcome of the incident and should be carried out in a systematic way to minimize the chances of rekindles happening. The process of overhaul

generally begins after the fire is extinguished or brought under control, and firefighters are able to move into fire-damaged areas and finish extinguishment by examining burned contents and opening the building's suspected void spaces, typically the walls, floors, and ceiling spaces, to search for hidden fire.

Safety first!

Firefighters must always keep personal safety in mind, even after the bulk of the fire has been extinguished. During overhaul, it is necessary to use complete personal protective equipment, including self-contained breathing apparatus (SCBA), unless the atmosphere has been determined safe to operate in without it (fig. 21–17). A company-level officer should be assigned the responsibility of supervising safety and the overhaul effort in each area where it is performed. The officer should watch for any problems and also monitor all radio communications. If fire is found to be spreading quickly to other areas of the structure, it is that officer's job to alert other crews and the IC about changing conditions or fire travel, or anything that might affect the safety of others working.

Before overhaul begins, it must first be determined if the building is safe to be operating in. In situations where there has been severe fire damage to the building's structural components, it will be the IC's responsibility to determine if it is safe to work in. This decision should be based on reports from company officers, firefighters, and the IC's own personal observations of the structure's condition. Fire service history has taught us that it is this time of a fire incident that is very dangerous and in some cases deadly to firefighters. In other situations where firefighters have had a tough, punishing fire, they can be fatigued from physical stress and effort. It can be times like this when firefighters lets their guard down about the building or fire conditions and just want to get the rest of the job done and get back to quarters. Perhaps there are obvious safety hazards, but they are not being recognized or considered. Here is where we can get into trouble.

Fig. 21–17. Numerous toxic gases are produced during the decay stage of a fire, when overhaul takes place. Therefore it is imperative that firefighters always wear SCBA.

Some points to consider before overhauling a structure are the following:

- Building construction type and type of materials used in its construction: Is there any fire damage to them?
- Occupancy of the building and its contents: Are there any unsafe or hazardous materials involved?
- What is the volume of fire and the length of time the fire has been burning?
- What is the actual damage to the building's structural system?
- Length of time for extinguishment process, namely water: How much was used and for how long?
- Are there any telltale signs of a weakened, unsafe structure that may be a collapse hazard, like any sagging roofs or exterior walls that may be bowing outward?
- Is there any water running out from any part of the building?
- Are there unstable chimneys that may topple?
- Is there enough lighting to see inside the building? Do lights need to be brought in?

If firefighters are already operating inside the structure, are there any reports of water pooling or building up on floors? Do any of the floors feel springy or spongy? Are firefighters reporting any unusual sounds or occurrences within the structure, such as ceilings dropping or wall plaster falling to the floor, or sounds like cracking or stressing noises? Is there a buildup of water on any

flat roof surfaces, indicating a weakened roof that is developing a new concentrated, live load? If any of these points is happening, it may be prudent to remove firefighters from the area or building until a further determination can be made concerning the structure's stability. Firefighters noticing any of these signs or other things need to make sure everyone on the scene is alerted to the possibility of an unsafe environment.

Having a plan and where to begin

Just as every fire should have an attack plan, the overhaul process should have a plan, too. Generally, the fire's location within a building is the starting point for the process, and more than likely, that is where overhaul will begin. Remember, that while fires have six sides—front, rear, both sides, top, and bottom—so too does the overhaul process. Firefighters need to remain proactive during overhaul and be suspicious of fire travel. To illustrate this point, picture a fire that has been localized and confined to one or two rooms on the third floor of a four-story garden apartment building. Firefighters need to check if the fire has extended beyond these rooms. Fire remaining unchecked in any wall, floor, or ceiling void spaces or pipe chases could eventually find its way to the cockloft space over the entire structure and cause tremendous damage. The best way to know for sure is to have a crew go above, below, and around the fire area to examine for fire extension. Visual investigations or observations along with good radio reports will help keep everyone aware of the fire's activity—its location, what it is doing, and where it might be going.

If the fire building itself is large and has sustained a substantial amount of fire damage, or if it has a large amount of contents that will require considerable attention, there will probably be extensive overhaul efforts. The IC might consider making a request for more firefighters to the scene to set up and rotate overhaul crews. This move serves to gives those who have already been working at the fire a break, and it helps to spread the workload by bringing in fresh, alert personnel.

Before beginning overhaul, it is important for firefighters to be fully aware of the damaged area(s) and to be looking for possible causes of the fire. In some cases, burn patterns will give clues as to damage and ignition sources. If these are detected, everything should be done to preserve evidence and not destroy or remove any evidence until fire investigators arrive and are able to determine its importance to the fire's cause. In many instances, firefighters begin overhauling and destroying evidence or end up throwing it out of the building.

Attack hoselines

Attack hoselines should not be removed from any areas needing overhaul. Where there is suspected fire travel, hoselines should remain charged and in place until overhaul has been completed and the IC has approved it. In far too many instances, fire departments have placed too much reliance on a single hoseline to extinguish a fire and cover all the potential points of fire travel and extension. After fire has been discovered extending to different areas, the time and effort used to reposition this line might let a fire gain great headway, growing more than the single line of hose can handle. Incidents like this have resulted in greater loss and, in some cases, firefighter injuries. Fire departments should know when and where multiple hoselines should be stretched for efficient coverage. An old adage of the fire service says where fire extension is suspected, don't send a crew to investigate ... send a hoseline and tools!

Tools and equipment

The task of overhaul is generally one of manual labor, meaning hard physical work. The tools used most commonly to accomplish this are hand tools of the pushing, pulling, striking, and cutting variety, but in some cases power tools are used also. Some of the more common tools are axes—both pick-head and flat-head axes; pike poles of different styles and lengths depending on the amount of reach or pulling needed; Halligan and Kelly tools for prying or leverage; shovels; and power saws, both chain and rotary. Other useful tools include rubbish hooks, carryall bags, and even wheelbarrows.

Detecting fire

After the main body of fire or flames have been knocked down or extinguished, it may be hard to actually know if there is any remaining fire due to poor visibility—all that is visible might only be the blackened, charred remains. Many firefighters have been fooled after a fire has been knocked or extinguished and the smoke has been removed from the room, only to have the room fill with smoke and heat minutes later from fire burning behind the walls or ceilings. In these cases, firefighters might have to use their own senses to find hidden flames, such as in the following examples.

Sight. Look for the following:

- Discoloration of paint or wall coverings
- Blistering or bubbling of paint or varnish or shellac finishes
- Heavily damaged or severely burned areas showing extreme amounts and depth of charring
- Smoke coming from around window or door frames or moldings, or registers
- Small sparks or cinders dropping from ceiling areas
- Smoke arising from floors, especially finished floors with subfloors
- Openings (vents, shafts, etc.) near the fire that may be allowed heat and smoke to travel to other parts of the building

Touch and feel. Use the back of your hand to touch suspected hot surfaces, first sensing for heat without pressing your skin to the suspected surface.

Hearing. Listen for the following:

- Any sounds of crackling or snapping as so often happens when wood burns
- Sounds of pressure building from pipes or other vessels

Smell. Use your sense of smell to detect the odor of fresh wood burning or other fresh smoke. If odors are noxious or smoke appears to be building in volume, then redon your face piece for personal safety.

Technology for detecting fire or heat. In the past, firefighters had only their learned principles of techniques and good instincts to help them search out hidden pockets of fire. Many times, firefighters worked extra hard trying to find the source of odors of smoke, only to find nothing, and so they would leave the building to return to quarters, only to return an hour or two later to find a fire roaring out of the windows and through the roof. Nowadays, there is a great tool that employs modern technology that most fire departments have or at least have access to. It is the thermal imaging camera, commonly called TIC (fig. 21–18). Using this device allows firefighters to detect heat or fire in hidden spaces without having to tear a room completely apart to find it. This saves time, effort, and guess work. The TIC is especially useful for the scenarios already described in this chapter, and it has many other uses where any amount of heat greater than the ambient area temperature can be identified through observation on the camera screen.

Fig. 21–18. Thermal imaging technology has allowed the overhaul process to be less damaging to property and more time efficient.

Opening walls, floors, and ceilings

SKILL DRILL

Before any wall, ceiling, or floor enclosure is opened, first determine if there is a real need to do so! In far too many cases, firefighters have caused needless damage to occupied buildings during overhaul by opening areas where there was no fire, nor was there any threat of fire extension. This makes firefighters and their fire departments look less like the professionals they want to be. And their community will perceive that, too. However, when done properly, the overhaul process will leave the building with no fire remaining, and a structure that will sustain minimal damage.

Ceilings need to be opened whenever there is a concern of hidden fire. In obvious situations where there has been substantial fire damage to a room, there will be no question about the need to open the ceiling, especially above the area where the fire burned. When ceilings located below cockloft or attic spaces are opened and there is a large volume of fire found, the burning area should be opened completely for extinguishment and further examination. If the fire is found to be extending horizontally, firefighters may need to get ahead of the fire's direction of travel and begin pulling down the ceiling in that area to cut off or limit the fire's spread. Once the fire is stopped, the entire ceiling will now need to be opened because of the threat of sparks or embers remaining. When fire is found in a ceiling space, the firefighters who found it should make sure this condition and the need to get above it are communicated immediately to everyone.

A special technique for opening walls and ceilings has been developed by Lt. Michael Ciampo of the New York City Fire Department (FDNY). Called the punch

technique, the firefighter uses a hook on ceilings and a Halligan tool on walls to create a series of initial perforations in the gypsum board to precut the surface, before removing the gypsum board. Once the perforations have been made, the firefighter can easily and effectively remove the gypsum board in large sections (figs. 21–19 and 21–20).

When it is time to open walls, it should be done completely from stud to stud and floor to ceiling (fig. 21–21). Doing this will expose the channel(s) and allow firefighters to see if there has been any charring inside the wall space. Remove the baseboard to expose the bottom of the wall and edge of the floor. If fire is found in several wall bay spaces, they must be opened completely. A concern here is if the fire in the wall spaces is extending either up or down vertically, especially in balloon frame construction. If a wall is opened and fire jumps out, it should be extinguished by the hoseline, and then the nozzle should be pushed into the wall space to direct water up and down the space to knock down any possible extension. Once again, the officer supervising should contact everyone by radio or verbally to let them know about extension and that crews should be ordered to check for it. Fires in outside walls will need to be checked on the outside of the structure, also. Fire traveling up an outside wall can extend to the upper parts of a building and may reenter the structure.

Fires hidden in floors or floor spaces can require extra effort, depending on the type of floor. In many residential structures, the floor is plywood laid over wood joists or trusses. There may be a layer of carpeting or linoleum on top of that. For others, there may be a subfloor of plywood or floor planks, then a hard wood floor on top of that. Still other residential floors have this supporting system with ceramic tiles for the finish. In any event, the firefighter must first understand the type of floor and the strength of its supporting system in order to determine the safest method to open the floor (fig. 21–22). For example, where there is carpeting, it may be best to cut carpet away with a utility knife before any tool use. If it is a wood floor, it may be best to use a power tool for cutting, as an axe may bounce away or glance off the floor boards when struck. Ceramic tiles may need to be struck with a maul or sledgehammer first.

Fig. 21–19. The ceiling punch technique involves using a pike pole to weaken gypsum board so that it can be removed more easily in large pieces.

Fig. 21–20. The wall punch technique works in a similar manner to the ceiling technique. However, the tool of choice for this evolution is the Halligan.

Fig. 21–21. Firefighters must expose the interior of a wall surface to prevent rekindle during the overhaul process.

Fig. 21–22. When opening up floor assemblies, firefighters must be careful not to cut through the beam below, compromising its load-carrying capability.

Roof overhaul

Different kinds of buildings have different kinds of roofing systems. Because of that, it is important for firefighters to recognize different types of building construction and roofs. Structures have different types of roof-supporting systems and roof-covering materials. Anytime fire or heat has reached the roof area, the roof must be examined for fire (fig. 21–23). In many cases this means the roof decking and covering must be removed. Appropriate methods and proper tools should be used, as this task is labor-intensive.

Fig. 21–23. The roof assembly must always be analyzed and opened up if it has been involved in fire.

Some structures have roof systems that are totally combustible, meaning the rafters, ridge boards, decking, and shingles can burn, whereas others may have a metal deck and an insulation covered by roofing materials, finished with an asphalt-type coating. In these cases, hand tools are most likely to be used along with hose streams. Sometimes power saws can be used to cut away portions of the roof to make less work. If necessary, the job can be done from a roof ladder, aerial ladder, or tower platform.

Techniques for overhaul

Once the flames are knocked down and overhaul has started, the manual work with hand tools begins. It is best for firefighters to have an assortment of tools with them in the structure to deal with the different overhaul needs. Here is where another old fire service adage applies: "The firefighter should let the tools do the work." Firefighters who do not have the right tool for the job will end up working harder to get things done. Firefighters should first examine the type of structure they will be overhauling and take the right tools in the first time. Many times firefighters have tried to make up for not having the right tool for the job and have worked extra hard to do a task, only to receive an injury for their effort.

An example of proper tools for the job is where fire is found in the first floor of an older two-story multiple-occupancy structure that has 12-ft (3.7-m) ceilings that need to be opened to check for fire extension. Firefighters generally carry 6-ft (2-m) pike poles for residential structures, but in this case, the firefighter needs at least an 8-ft (2.4-m) pike pole or ceiling hook.

The firefighter should hold the hook or pike pole so the hook end faces away. As the firefighter pierces the ceiling with the point, it may be necessary to turn the pole at a quarter turn so the business end punches past the lath or ceiling surface. The pole is then turned so the hook once again faces away. The firefighter should locate the joist to which the lath or ceiling is attached, then position the hook along side of it. As the firefighter pulls downward and to his or her front area, the connections between the two are broken, releasing bigger pieces of the ceiling area. The firefighter should open up as much as is necessary to get to clean wood.

Overhauling building contents

When overhauling the contents of a structure, sometimes all that is necessary is to use a stream of water from a hoseline. But in some situations, other methods are necessary to get the job done. For example, a bedroom has sustained heavy fire damage, and there was some extension into the hallway. There will probably be extensive overhaul needed. There might be clothing hanging in a closet that is still smoldering. There might also

be window drapes or shades that need attention to be sure they are extinguished. Instead of using the force and volume from the attack hoseline to do the job, firefighters can pick up the clothing articles and take down the shades and drapes, and remove them all to the outside or into the bathtub for a dousing (if the tub is still in service). There may be piles of clothing in the room also smoldering. In some cases, a bucket of water or a tub nearby with water in it can serve the purpose.

If you find it necessary to remove the contents from the structure, ensure that proper safety procedures are followed. Never just throw things out of a window—make sure the area below is clear before dropping the objects. In tall multistory buildings, never use the elevator to remove mattresses and the like—they have been known to flare up inside the elevator, endangering firefighters. Roll up and tie mattresses with rope before bringing them down through the building stairs.

There will be fires in occupied structures where the owner or occupant has smaller, valuable items found after the fire, such as items on a dresser or shelf. It may be best to get a box or other container to put them in for safe keeping while they are returned to the owner. Care should be taken to minimize any breakage by firefighters. This action can serve three purposes: (1) it helps to save something that might be very valuable to someone; (2) it helps firefighters to minimize property loss; and (3) it can build positive public relations between the fire department and its community and make a positive situation from a bad experience for someone.

When overhauling, there is a natural tendency for firefighters to use water heavily for final extinguishment. Firefighters may be tired and want to get done quickly, especially if there was a well-involved fire situation necessitating a lot of hard, physical work. There is always the belief that insurance is going to pay for the loss to the owners anyhow! If the structure is not going to be rebuilt and will be demolished, then by all means use as much water as needed to make sure a rekindle does not happen. But where fire damage is limited in size and if the building is going to be repaired and reinhabited, then firefighters should be careful about the amount of water used during overhaul. If there is any question in this case, then maybe overhaul efforts were not thorough enough to open all areas of potential fire spread, and water is being used to flood it out. This will lead to unnecessary water damage, and it could lead to an uninhabitable building. Officers and firefighters should always be aware of the amount of damage caused *after* overhaul efforts.

Tips for overhauling

- Determine that the building or structure is safe for personnel to operate in.
- Maintain communications and control of the task (company officers).
- Have a plan on where to start and where to suspect likely fire travel.
- Make sure firefighters use the proper tools and techniques for the task at hand.
- Keep hoselines charged and in place until they are no longer necessary.
- Ensure that holes in the floor or other safety hazards are identified, and proper barriers are placed to protect firefighters operating in the area.
- Perform overhaul in coordination with other operating crews.
- Remove debris to the outside to be completely extinguished.
- Look for any possible signs of how the fire may have started.
- Cover any windows or openings in an occupied structure to prevent any further damage.
- Before leaving the premises for the final time, conduct a walk-through of the structure to ensure there is no remaining fire. You must avoid an embarrassing and dangerous **rekindle**—a situation in which a hidden smoldering fire reignites after your departure, setting the building on fire again. Use all of your senses and the thermal imaging camera to search for any hidden fire.

Preserving fire scene evidence and arson

FFI 5.3.13 During the entire incident—from dispatch to picking up and returning to quarters—firefighters should be aware of any unusual signs or clues that might lead to an explanation of what may have started the fire. (Fire investigation is covered in detail in chapter 32.) During overhaul, firefighters are likely to come across things that might point to where the fire started and what may have caused it. Signs of origin can include:

- Location of fire or point of origin
- Single or multiple fire locations

- Direction of fire spread
- Faulty wiring or electrical equipment
- Signs of accelerants
- Cans or container
- Unlocked doors or signs of forcible entry

When signs are noticed, firefighters should be careful not to destroy any evidence or throw anything out that fire investigators might find useful in their probe. If possible, notify investigators and stop the overhaul process as long as the fire is under control. Should firefighters discover the cause or perhaps find something that might point to a crime, do not disturb any evidence if possible—notify investigators immediately and protect the scene.

Arson is the intentional setting of fire to a building or object for the purpose to destroy it. There are many reasons why someone would perform this crime, and that is why it is so popular. Arson can be a very costly crime when all things involved are considered, including firefighter health and safety. Sometimes a building is rigged to burn quickly, and that could lead to a structural collapse that might injure firefighters.

Because firefighters never know when an arson fire will happen, they must be alert to signs that point to arson. For example, if you are a member of the first due company on the scene of a structure fire that is well-involved, and your response time was very good, that might be a clue. If you are stretching in your initial attack line, and it is an occupied house, but the owners are not on the scene and the side door was found open, there might be another sign. As you have knocked the fire down and are beginning overhaul and you smell an odor like that of gasoline or another flammable liquid, then you very possibly have an arson fire to deal with. All this information should be given to the IC, who will then notify the fire investigators. During your overhaul, be on the lookout for anything unusual or any container or flammable liquid stains. Be careful not to disturb anything that looks out of place in a normal living environment. Remember not to destroy this crime scene.

QUESTIONS—SALVAGE

1. How do you think you and your department can be prepared for preventing extensive water damage to property with minor fire conditions?
2. In a multi-story occupancy, on what floors will the salvage operations generally begin?
3. When the fire has been knocked down and the fire floor is measuring inches of water, what are a few techniques learned in this chapter that you as a firefighter can use to alleviate the excessive weight of the water condition?
4. Discuss some ways you can cover holes in the floor or warn others of potential risks resulting from fire suppression efforts.
5. Why is it important to secure a building or door after firefighting operations have been concluded?
6. List some tools you believe would be essential in the preservation of people's property after the main body of fire has been knocked down.
7. Why is it important to follow through with the shut-off of all the utilities before entering an area with standing water?
8. How would you clear a flat-roof drain to allow water to run freely and remove the added weight caused by water on the roof?

QUESTIONS—OVERHAUL

1. When searching for extension of fire in an adjoining room or attached structure and a minor fire has been knocked down, why is the use of thermal imaging cameras a good practice to follow?
2. In a multi-story building, do you think it is safer to remove smoldering mattresses down the interior stairs, creating a tripping hazard to firefighters, or to quickly bring it down an elevator?
3. Is it helpful to the fire investigators to remove suspicious items or appliances that may have caused the fire?
4. If you are responding to a commercial occupancy, which size of pike pole would you take? Answer the same for a two-and-a-half-story private dwelling.
5. How would you prepare to check for extension in the floor before actually getting down to the plywood for various flooring types, and what tools would you use?
6. When the main body of fire is knocked down by the firefighters, should the hoseline stay in place while overhaul takes place, or should it get out of the way of members performing overhaul? Why?
7. What must be done next if fire is found in wall bay spaces?
8. When is it safe to remove SCBA during overhaul?
9. If you can summarize the definition of overhaul, what would it be?