

**April, May, June 2004 Newsletter**  
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## **Salvage and Overhaul Operations**

After a fire has been extinguished and the cause-and-origin investigation completed, firefighters regroup at the point of fire origin for salvage and overhaul duties. The officer must control and organize the salvage and overhauling operation. The hose stream is temporarily withdrawn and the proper tools are brought to the work area. Salvage and overhauling should begin at the room of fire origin and work outward. Firefighters should be assigned specific areas to overhaul. In a typical residence building, one firefighter can easily overhaul one room. When two firefighters are working in close proximity to each other, the officer should supervise and coordinate their work to prevent injuries. When there are more firefighters available than necessary to perform the salvage and overhauling work safely, the officer should order the extra firefighters to perform other tasks. For example, the electric and gas utilities to a burned-out apartment can be shut off. Portable lights and fans can be placed in the area of salvage and overhauling and unnecessary tools and ladders can be replaced on apparatus.

### **Checking for concealed fire**

When a blaze is extinguished, the first action taken is to protect the occupant's belongings and furniture. Move them or cover them, then start pulling ceilings. If a thermal imaging camera is available check for hot spots. If the thermal imaging camera does not indicate hidden fire behind the ceilings or walls do not open the plaster sheathing. Check the suspected ceiling and walls with the thermal imaging camera again before leaving the scene. When necessary open up the sections of the ceiling over the fire areas to check for hidden flames or smoldering fire in concealed ceiling spaces. When several firefighters are using pike poles to pull down sections of large ceilings during overhauling, dangerous, sharp objects are falling around their faces, which could cause

blindness or a disfiguring facial scar. Firefighters need to protect their eyes while pulling ceilings. Many firefighters are injured during the overhaul process by falling debris, suffering facial or eye injuries when their safety shields are not in place. Firefighters pulling ceilings have been injured by rusted nails attached to plasterboard, sharp wood splinters from broken wood lath behind plaster ceilings, sharp edges of ornamental tin ceilings, light fixtures swinging down from ceilings, hanging electric cable, electric conduits, gas tubing, plaster dust, asbestos and fiberglass insulation. Even the pointed edges of other firefighters' pike poles have struck and injured nearby firefighters. Most firefighters have helmets equipped with eye shields designed to be lowered during this dangerous overhauling stage of a fire. In some instances, foolish though it may be, the eye shields are not used. Firefighters should use masks during overhauling when hazardous dusts or airborne particles can be ingested.

Another cause of injury during ceiling pulling is the improper use of the pike pole. The firefighter must first check the forward position of the metal hook before he or she raises it into the smoky upper levels of a room to pull down a ceiling. Next, the firefighter must glance up at the charred ceiling while the officer's light beam is pointed to pick the spot for hook penetration. Finally, the firefighter must look downward and drive the hook point up through the charred plaster ceiling, making several short, sharp, downward pulls. If the pike pole is pulled down too forcefully, the firefighter could lose control of the tool and accidentally strike another firefighter with it.

### **Removing Smoldering Chairs and Mattresses**

Charred, stuffed chairs, couches and mattresses often reignite and flame up after they have been extinguished with hose streams. They should be removed to the street. The cotton padding exterior prevents water from penetrating the interior of the piece of furniture. The combustible wood frame, horse hair, sisal or other stuffing used in the interior, together with the air space created by the inner springs, allows a hidden spark to smolder and reignite hours after the outer surface fire has been extinguished. There have been tragic instances in which a fire in a chair or mattress appeared to be extinguished during overhauling and was left in the house. After the firefighters returned to quarters, the stuffed piece of furniture reignited, creating a second, larger fire

and taking lives. For this reason, many fire departments have an overhauling policy of removing cotton-padded stuffed chairs, couches and mattresses to the street. They are cut open, pulled apart, soaked by a hose stream on the inside and outside and, if necessary, broken up. There is nothing as damaging to a fire department's reputation as a "rekindle" of a fire after firefighters have left the scene. The sudden re-ignition of a stuffed chair or mattress can injure a firefighter. There have been many instances in which a smoldering mattress being carried down a stairway to the street suddenly reignites, flames up, becomes stuck in a stairway or doorway and a firefighter gets burned. Any cushioned chair or mattress that is smoldering in a hot, damp, smoky apartment can suddenly burst into flame when carried down a stair or out a hallway where cool, fresh air flows around it. Before a smoldering mattress or cushioned chair is carried or dragged outside, it should be cut open and the interior soaked with water. If this cannot be done, a portable extinguisher or hoseline should be ready to quench any reignition of the furniture as it is carried outside. For these reasons, smoldering mattresses or stuffed chairs should never be taken down to the street in an elevator. There have been cases in which building superintendents have removed smoldering furnishings from upper floors of high-rise buildings via inside elevators. They were trapped in the elevator car by the reignited mattresses and burned to death before the flaming car reached the lobby.

### **Discarding Rubble Out of Windows**

A dangerous task carried out during overhauling is throwing a smoldering mattress or stuffed chair out of a window. Dropping rubble from a window into the street or yard without communicating such intent to firefighters below could cause death or serious injury. The falling piece of furniture may strike a firefighter who is about to walk out of the fire building. Even fire rubble thrown out a rear or side window could injure a firefighter about to climb a fire escape or raise a ladder. One evening, firefighters entered a multiple dwelling for a smoky fire on the fourth floor. The fire in the living room was extinguished quickly, the room vented and a victim dragged out of the apartment. A smoldering chair was carried to a rear window, maneuvered onto a fire escape and tossed over the railing into the dark backyard. Down in the backyard, however, a firefighter from a second-arriving ladder company was moving to lower the fire escape "drop

ladder" and climb the rear fire escape. He was struck by the falling chair. He suffered brain damage and had a permanent loss of balance when walking.

If it is absolutely necessary to throw a piece of rubble out of an upper-floor window,

1. The company officer must first notify the officer in command of the fire. Request permission to discard material out the window.
2. The incident commander or the officer directs a firefighter as a guide at the base of the window.
3. The guide insures no person can walk in the area where the debris is to be thrown.
4. The guide informs the officer of the company when it is safe to throw the material out the window. Only after receiving the "all clear" from the firefighter guide below is the smoldering rubble thrown out of the window. Shouting "Watch out below!" is not sufficient.

### **Carbon Monoxide in Below-Grade Areas**

After a fire has been extinguished, and before overhauling requiring ceilings and walls to be opened, utilities should be shut off to prevent an explosion or electrocution. Firefighters should be sent to the cellar of the fire building to shut down affected utility services. Gas meters are shut off if the pipes are broken; electric meters are shut off where water has caused electrical wires to short circuit; sprinklers are temporarily shut off in the cellar, in order to change a fused sprinkler head. Warning! Firefighters sent to cellars to perform these duties without self-contained breathing apparatus (SCBA) have died and caused the deaths of other firefighters coming to their rescue. Consider the possibility: A firefighter who descends into the cellar without a mask falls unconscious, overcome by accumulations of carbon monoxide from the fire that's just been extinguished. After realizing that he's missing, two or three of his buddies rush to the cellar - also with-out masks and are quickly over-come. Finally, a firefighter enters the cellar with SCBA strapped on and operating. An emergency call is radioed to the firefighters above and the unconscious firefighters are dragged up out of the cellar. Their bodies are examined. The degree of brain damage and the number of dead firefighters will depend upon the sequence that each mask less fire-fighter is dragged out and the time it took for the first firefighter with SCBA in place to enter the cellar. Firefighters descending cellar stairs during overhauling must consider the

possibility of colorless, odor-less, deadly carbon monoxide and other toxic smoke accumulation in the cellar at all times, but particularly when:

1. A fire of long duration has just been extinguished.
2. The fire location is a store on the first floor, directly above the cellar.
3. The cellar is completely below grade.

### **Electricity**

Research into electrical dangers on the fire ground is misdirected and misleading; it concentrates on the conduction of electricity through hose streams. However, most firefighters who are electrocuted are not directing hose streams - they are holding a metal tool or a piece of metal equipment that comes in contact with live electrical equipment. Firefighters carrying metal tools and metal ladders near electrical equipment are in danger of being electrocuted. When a metal tool or ladder accidentally contacts live electric power, the firefighter's body completes an electric circuit. Current is relayed to ground through the fire-fighter's body more readily when clothes are wet and when he or she is standing on a wet surface. During overhauling, firefighters and floors are wet. Firefighters using metal tools should treat all electric equipment as live and avoid coming in contact with it during the overhaul. If sparks or shocks from electric equipment are received, the officer should be notified of the danger and the electric supply shut off. Before shutting off any electric supply, firefighters should be equipped with nonconductive gloves, shields should be in place and they should be standing on a dry, nonconductive surface.

Another electrical danger to fire-fighters during overhauling is arcing. Arcing is the condition by which a large electric spark jumps between two closely spaced conductive objects when electric current is interrupted. One of the conductive objects could be a firefighter. A spark could jump from an electrical supply panel into a firefighter who is shutting off electrical supply and standing on a conductive wet floor. Arcing often occurs when a switch is opened or fuses are pulled to interrupt or shut off electric power. The arcing of electricity could severely burn a firefighter.

### **Floor Collapse**

Before salvage and overhauling begins, a safety survey should be made of the structure by a safety chief. If the building is unsafe, salvage and overhauling operations should not be undertaken. “Hydraulic overhauling” or so-called “defensive overhauling”, (washing down the interior of the structure with firefighters operating master streams from outside the burned out structure and from a safe distance outside collapse danger zone, This is a done instead of sending firefighters inside to quench small spot fires.) should be considered, or a “watch line” set up outside the building for several days to prevent a rekindle from spreading to adjoining structures. Sometimes, when a serious fire involves several floors of a structure and outside master streams are required to extinguish the fire, fire-fighters must be sent inside to complete a search or secondary search for victims and to overhaul the gutted building. If salvage and overhauling are undertaken, firefighters must be aware of the danger of collapse. This is because the structure was destroyed by flame, weakened by the impact of pounding master streams, and overloaded with the weight of tons of water soaked into the plaster and wood. The most dangerous collapse area inside such a burned-out residence structure is the bathroom. When a firefighter enters this room to search or overhaul, the floor joist may suddenly fail and cause the collapse of the entire bathroom floor. The fire-fighter, along with heavy cast-iron sinks, bathtubs, porcelain toilets and heavy tile floors, will crash into the basement or the floor below. There are several reasons why the bathroom floor is more susceptible to collapse than other floor areas:

1. The bathroom fixtures create a heavy dead load. Cast-iron tubs and sinks and porcelain toilets can weigh up to 1,000 pounds. This weight is concentrated in one small area.
2. In some older buildings, the thick tile-and-sand-bed floor installation required the floor beams to be reduced in size.
3. The moisture from sweating or leaking water pipes over the years can cause the wooden bathroom floor joists and floor beams to rot or weaken.
4. The bathroom floor joists are more likely to be destroyed by fire because the bathroom often has the most poke-through holes and concealed avenues of fire spread. Fire burning upward from

one floor to another will seek out the path of least resistance: the bathroom floor. As the flames spread up through bathroom poke through holes, it weakens the floor joists.

During overhauling operations in a seriously damaged bathroom in a multiple dwelling, firefighters should attempt to open up a fire weakened ceiling or wall using the reach of a pike pole and standing outside the bathroom. Firefighters using a hose stream to wet down a burned-out bathroom should also stand outside the room and use the reach of the hose stream to extinguish any small pockets of fire.

### **Gas Explosions**

When advancing an attack hose line and firefighters see a burning gas meter the flaming gas should not be extinguished. Let the gas fire burn and extinguish the rest of the fire. However when a fire company extinguishes a smoky room-and-contents fire in a kitchen or basement, the hose stream may accidentally extinguish a gas fire from a melted or broken gas pipe, tube or meter. The unburned gas leaking into the charred room may be suddenly reignited by a smoldering ember and explode violently. The time between when a house fire is extinguished and before overhauling begins is a dangerous stage of a fire. Gas explosions often occur at this time. Gas meters melt, copper tubing softens and separates, and pipe joints come apart when ceilings collapse. The leaking gas is ignited by smoldering nearby material. The presence of leaking house-hold gas must be determined after a fire has been extinguished and before overhauling begins. Both natural gas and bottled gas are required to be odorized so that they can be detected by a person at gas concentrations in air not exceeding one-fifth of the lower limits of flammability. However, this odorization is not effective in smoke-filled rooms for firefighters wearing SCBA. The most effective action a fire-fighter can take immediately after a fire has been extinguished is to prevent an explosion by venting the fire area. Next, any gas appliances should be checked for leaks before overhauling. Some fire officers carry putty or clay to quickly plug up broken or leaking gas pipes; a rag or soap can be used to temporarily plug up escaping flammable gas while other fire-fighters are simultaneously venting windows. It is erroneous to assume that a flammable gas-air mixture needs to completely fill a room or building before an explosion can occur. Most combustion explosions inside buildings occur with less than 25% of the enclosure

filled by the flammable gas-air mixture. If an explosion of reignited gas does occur, the gas burning at the appliance should be allowed to burn until the flow of gas to the broken pipe is shut off. The room-and-contents fire should be extinguished and the exposures protected but let the gas continue to burn. .

### **Heat Exhaustion and Overhauling**

While performing rescue and hose line attack during the firefight, firefighters are exposed to three types of stress:

1. Physical stress from hose stretching, forcible entry and raising ladders.
2. Emotional stress from the fear of death or serious injury caused by flashover, explosions and collapse.
3. Heat stress caused by exposure to high temperatures of the flames, heated smoke and gases, ambient temperature and the insulation effects of protective clothing.

Once a fire has been extinguished and the dangers are reduced, the physical and emotional stresses are no longer great; however, the heat stress continues and for some firefighters actually worsens during overhauling. After the tremendous effort expended during the fire and rescue operation, firefighters regroup inside a hot, steamy, heated, burned-out structure to start strenuous overhauling, looking for fire extension, extinguishing spot fires and removing burned rubble. It's then that heat stress begins to affect firefighters. They may suffer heat cramps, heat stroke or heat exhaustion caused by elevated body temperatures. Rookie firefighters are particularly susceptible to this injury. Trying to prove themselves as firefighters, they overexert themselves both during and after a fire. The symptoms of heat exhaustion catch up with them during the overhauling stage. Veteran firefighters should know how to pace themselves and save that extra bit of energy for the overhauling operation. When a firefighter begins to experience heat exhaustion, he or she sweats more than normal, may feel a tingling in the arms or legs, turns an ashen or gray color, has difficulty breathing, feels nauseous and possibly vomits. Any of these symptoms is a signal to slow down. Notify your officer that you need a break. If possible, go back to the apparatus and get a drink of water to replenish your loss of water from perspiration and take off your helmet, protective hood, and turnout coat. If there is a "rest-and-recuperation



unit" on the scene, ask for assistance. Don't try to fool yourself, your supervisor or your department - take a break from firefighting. It's better to take a short rest than to drop unconscious inside the burned-out fire structure. Even if you are able to go through the motions of overhauling while feeling exhausted, you may cause an injury to a fellow firefighter. It's a well-known fact that exhausted and overexerted firefighters make poor decisions on the fire ground. Many fire ground injuries that occur during the overhauling stage of firefighting are caused by firefighters, officers and chiefs whose judgment is impaired by exhaustion.

### **Lessons Learned**

A fire officer should instruct fire-fighters to perform several actions before salvage and overhauling operations begin:

1. Conduct a collapse danger survey and rope off danger areas.
2. Set up portable fans to remove toxic smoke and gas.
3. Set up portable lights and power supply.
4. Survey walls and ceiling with thermal imaging camera for hidden fire
5. Shut off utilities of gas and electricity.
6. Determine the fitness of firefighters and select those most able to perform overhauling. Rest and rotate the others. If necessary, ask the fire ground commander to call fresh companies for overhauling.
7. Assign firefighters specific areas large enough to provide safe work areas.
8. Supervise and coordinate over-hauling in close quarters where two or more firefighters must work together.
9. Require that SCBA face pieces and eye shields be in place when pulling ceilings.
10. Notify incident commander if any smoldering rubble must be thrown from a window.

### **Quiz for Salvage and Overhaul Newsletter:**

1. After extinguishment, salvage and overhaul should begin where?

- A. The perimeter room of burn out and move inward to fire origin
- B. The room of origin and move outward
- C. In adjoining apartments
- D. In cellar and work upward

Answer\_\_\_\_\_

2. After a blaze is extinguished what is the first action taken?

- A. Pull ceilings over fire
- B. Get thermal imaging camera
- C. Open walls
- D. Protect property

Answer\_\_\_\_\_

3. True or False

After the fire is fully extinguished it is safe to go to the cellar to shut off utilities without SCBA if there is only a slight smoke haze.

Answer\_\_\_\_\_

4. Before throwing rubble from a window the officers should take what action?

- A. Shout watch out below
- B. Notify incident commander
- C. Tie it up so it won't flame up
- D. Wet rubble down

Answer\_\_\_\_\_

5. Firefighters who are electrocuted are most often doing what action?

- A. Operating hose lines
- B. Carrying metal tools and ladders

C. Forcible entry

D. Venting

Answer \_\_\_\_\_

**Answers for quiz: 1. B; 2. D; 3.F; 4. B; 5.B**