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JULY-AUGUST-SEPTEMBER NEWSLETTER- FIREFIGHTERS CAUGHT AND TRAPPED

A 10-year study of the deaths of firefighters operating inside burning structures revealed that many of the victims were "caught or trapped" inside the structures and killed by flames, heat or smoke. Firefighters can be caught or trapped by flashover, backdraft-explosions or disorientation and killed by heat or smoke.

In New York, NY, in 1994, four firefighters were caught or trapped by fire inside burning buildings. In 1995, two firefighters were caught or trapped by fire inside burning buildings. In 1996, one firefighter was trapped by fire, in 1998 two fire officers were caught and trapped when a floor collapse, in 1999 an officer and two firefighters were caught and trapped in a hallway of a high rise, in 2001 three fire fighters where caught and trapped by an explosion. This cause of

firefighter death due to being “caught and trapped” is not limited to New York City. It is a national trend.

No one knows for sure why these deaths occurred but there are several theories: one theory is that structures have become more dangerous during fires. Energy-efficient renovated structures have insulated walls and ceilings, air-tight doors and double-paned windows. The Fire Service has identified this as "tight building syndrome. These structures contain fire and heat for long periods before discovery. There is little smoke or flame seepage from the structure during the growth stage of a blaze. However, when firefighters arrive on the scene after a delayed discovery and vent several doors and windows, large amounts of pent-up superheated flame and smoke rapidly spread throughout the structure's hallways, stairs and passage-ways, trapping firefighters.

Another theory suggests that the excellent protective equipment we fought so long and hard to get has a downside. The masks, bunker gear and hoods that so effectively protect us from burns also enable us to enter and search burning buildings faster and farther, sometimes getting us caught or trapped by fire.

Another theory points to the advances in forcible entry tool design, allowing firefighters to quickly open locked doors and enter a burning structure before a hoseline is in position. Still others say the reduction in personnel on hose-stretching teams has: 1. slowed the placement of 13/4inch attack hoselines; 2. reduced the frequency of companies stretching large 2 1/2 inch-diameter hose; 3. And cut the total number of hoselines a first-arriving assignment can stretch now that we team up companies.

Yet another theory is that the firefighting team concept has been weakened. Large turnover of personnel in the nation’s fire departments, changes in work schedules, out-of-company details and increases in acting company officers and chiefs have eroded the control, loyalty and authority of a close-knit fireground attack team.

Again, this is speculation; no one really knows all the reasons why firefighters are caught or trapped during structure fires. However, there is one definite culprit, one clear fireground

danger that causes firefighters to become caught or trapped by fire - and that is rapid, uncontrolled fire spread.

At a structure fire, the flames, heat and smoke spread rapidly and trap firefighters performing search and rescue. To survive structural firefighting and not become caught or trapped by flames, we must know all the ways fire spreads. The following is a basic review of how the products of combustion spread at a structural fire.

Firefighter Deaths Inside Structures (1984-1994) (NFPA Study)

Caught or trapped 113

Stress 42

Falls 10

Smoke 6

Carbon dioxide..... 1

Cold 1

Concealed Spaces

Most fires do not initially ignite a structure. Instead, the contents of a building are ignited and burn first, then flames spread to the structure. Stuffed chairs, mattresses, clothing and food cooked on the stove are items that initially burn. After the content fire is extinguished, fire officers must have firefighters check for fire extension to the structure.

As soon as possible after the knockdown of flame, officers should order hooks to be used to open up walls and ceilings near the fire to examine concealed spaces. First, the ceiling directly above the point of origin is opened. The plaster around pipe risers is also opened, and the ceiling light fixture is pulled to examine the areas behind. After this poke-through ceiling holes are checked for fire spread, the wall near a stuffed chair or couch is checked around the electrical wall receptacle. Fire may have extended into the wall. Rub an ungloved hand lightly across the surface. If it's too hot to touch, open the wall and check behind the plaster. If the wall is just

warm, do not open it. When you open up a space and discover fire, you must act fast to cut off the flames. Have a hoseline ready and quickly examine the concealed areas. For example, if you discover fire in the floor, open up the wall near it. If you discover fire in a wall, open up the ceiling above it. If you discover fire in a ceiling, open it up and check the baseboards on the floor above.

If fire in concealed spaces has spread to two floors above, check the cockloft; fire may already be there. Incomplete combustion inside a concealed space can generate carbon monoxide (CO) gas along with large quantities of smoke. The CO and smoke can disorient and trap firefighters. Masks must be worn.

Fire Spread in Hallways

When people flee a fire, they seldom take time to close the door to the burning room. When we arrive, flames are often spreading out into a hallway. Most fire spreads from a burning room through an open door, an unenclosed stair, a shaft or an open window; it does not spread through concealed spaces as often as it spreads through these normal openings. At a serious fire, first-arriving firefighters usually come face to face with flames spreading out in a hallway. While waiting for the hoseline to be flaked out and charged, and to prevent the hallway flames spreading over your heads and igniting the paint, close the door, attempt to control the open door by pulling it closed with a hook, utility rope or gloved hand if the doorknob has not burned away. When there are no trapped victims, keep a door to a burning apartment or room closed. This action gives us time to get our hoseline attack and search teams ready for action. If the door cannot be closed, flames are spreading along the hall-way ceiling and walls, and the attack hoseline is not charged with water, retreat down the hall to the stairs. Descend several steps to get below the rollover flame. When the hoseline is charged, advance back up the stairs down the hall and drive the fire back into the room of origin. When retreating down a hallway to the stairs due to rapid fire spread, officers must ensure firefighters do not get separated and trapped on the

hall side of the stair railing. You will not be able to get down the stairs, unless you quickly climb over the railing. Never go up the stairs to floor above to escape flames spreading out to a hall.

Stairway Fire Spread

In a multi-story residence, flames spreading out of a lower-floor apartment into a hallway quickly travel up the open stairway, trapping anyone in the stair enclosure. One of the first safety and survival firefighting procedures we learn is to not get caught above a fire in a stairway. Going above an uncontrolled fire in a multiple dwelling is extremely dangerous. Officers must instruct firefighters to never walk down a stairway from the roof, after venting the stair sky-light or bulkhead door. Flames, heat and smoke spread up stairways when the door to a fire apartment is opened. If the first attack hoseline does not quickly move in and extinguish the apartment fire, the stair-way can become a chimney.

Of the three types of heat transfer - convection, radiation and conduction - convection is the most common way a structure fire spreads. Convection currents of heat and flame spread up a stairway. Convection is the transfer of heat by way of a fluid. A fluid is a gas or liquid. Fire gases such as smoke and flame are the method convection heat is transferred during a structure fire. For example, as air is heated it expands and becomes lighter than the surrounding unheated air. This lighter air (flame and hot smoke) rises to the ceiling of a fire room and up a stairway. (Radiation occurs at a large conflagration and is defined as the transfer of heat through space. Conduction is the transfer of heat through a solid.)

Shaft Fires

In older tenements, the light shafts, dumbwaiter shafts and air shafts still exist; in renovated multiple dwellings, these shafts may be boarded up and concealed with plasterboard walls. The most serious shaft fire is one between two buildings. If the fire spreads into the shaft, two buildings are involved. Several years ago, the FDNY and Polytechnic Institute of New York conducted tests in three-story row-houses to study exactly how fire spreads in these buildings.

Several of the tests involved interior shaft fires. At one shaft fire experiment, a rubbish fire in the base of the shaft was ignited and allowed to burn freely. The shaft was between two buildings and open at the top. Windows faced the shaft. Flames spread rapidly up the shaft; fire leaped several feet above roof level. Fire extension into the building occurred first into the top-floor window opening, then the second floor and then finally the first floor. The highest temperatures with-in the shaft were registered near the top of the shaft.

What does this mean to a fire officer? It means that during a shaft fire, you must extinguish fire at the point of origin and simultaneously at the top floor. At least two lines are required at a shaft fire.

Cockloft Fire Spread

Why do some fires that extend to a roof space or so-called- cockloft - defined as the large concealed space between the top-floor ceiling and the underside of the roof deck – and then spread with explosive speed? There are three reasons for unusual rapid fire spread in a cockloft of a multiple dwelling or row of stores. One is arson. At an alarm for an odor of gasoline on the top floor of a large H-type dwelling several years ago, a firefighter searching for a source on the roof lifted up a vent and discovered four open one-gallon plastic containers that were filled with gasoline. The cloth wick extending from the opening of one container had only partially burned and had self extinguished.

Another reason some cockloft fires spread unusually fast is old leaking natural gas pipes. Gas piping for gas light fixtures and cooking stoves sometimes runs from top-floor occupancy to occupancy through the roof space above the apartment to large, old multiple dwellings. This old gas piping can develop small leaks over the years. Leaking gas can fill up a cockloft. When flames from a top-floor fire spread to the roof space, a rapid fire develops; sometimes an explosion occurs.

The third cause of a fast-spreading fire in the cockloft is the tons of exposed wood in the roof space. Dried out wood beams, bracing, underside of the roof deck, the ceiling lath and wood

furring can feed an explosive fire in the cockloft. Whatever the cause of a rapidly spreading cockloft fire, firefighters must realize a top-floor fire that has extended to the cockloft is more dangerous than a fire on a lower floor. Explosion and ceiling and roof collapse can occur, in addition to rapid fire spread, if there is gasoline or gas leakage there can be an explosion. Firefighters should be instructed to pull a top-floor ceiling near the room doorway. If the fire explodes the ceiling downward, an escape is possible, back out the door. Concealed roof spaces that contain combustible framework, such as wood roof beams, wood furring, bracing, lath and roof decking, are required by building codes to be subdivided by one-hour fire stopping. The concealed roof spaces are subdivided into spaces of 3,000 square feet or less. This compartmentation is designed to restrict the spread of fire in a concealed space such as a cockloft. But don't believe it. The fire stopping, which may include fire walls and party walls, often have poke-through holes that allow fire to spread. Workers often break through fire-stopping plaster partitions and even brick walls to run utilities through adjoining occupancies.

Parapet walls

A brick parapet wall above a roof may appear to be in good condition. It may have new well-painted masonry, no missing bricks and a new coping stone. However, if you pull the top-floor ceiling along the wall or cut the roof deck near the base of the parapet and look into the cockloft, you may find a different wall, with missing bricks, large poke-through holes for ducts and wire, or cracked and crumbling mortar.

What you see above a roof is not what you get in the cockloft. When builders renovate a building, they rebuild the parapet wall portion of a party wall, above the roof deck. The important portion of wall designed to stop fire spread in the cockloft below the roof deck, however, may be left crumbling and unrepaired.

Window Fire Spread

If the heat of a fire breaks a window or a firefighter vents a window and the burning room is not extinguished by an attack hoseline team, flames coming out of the open window can spread to the floor above or to an adjoining structure. Flame spreading from window to window, called auto-exposure, and must be considered a danger. These flames can trap a firefighter searching on the floor above a fire. A firefighter entering a floor from above can be trapped by auto-exposure. A firefighter, cut off by flames spreading up an interior stair, can be caught and trapped if auto-exposure prevents the use of a fire escape or ladder.

Fire officers must coordinate window venting of a fire area. When there are no preliminary reports of persons trapped, windows to the fire area should be vented, thoroughly and quickly, when the attack hoseline is advancing.

Venting saves firefighters' lives and can prevent flashover and backdraft when timed correctly. When flames spread from window to window above, if an outside hoseline is available, a quick dash of water against the spandrel wall - not in a window - may protect a firefighter trapped on the floor above by auto-exposure. A spandrel wall is the exterior wall between the top of one window and the bottom of the window above. When a firefighter is trapped at a window and flames are coming out over the head of the fire-fighter, if no ladder is available, direct a hose stream into the window over the head of the firefighter. This may keep the firefighter from jumping until a ladder can be positioned.

Lessons learned

After finishing this article about “firefighter’s caught and trapped”, I dropped it off at a firehouse for a friend to review. I asked this veteran engine company officer to read it and tell me what he thought of it, and also for his opinion on why firefighters are caught and trapped when fighting structure fires. Several days later, I stopped by the firehouse and asked my friend what he thought of my article. He gave me a cup of coffee along with his comments. "No offense meant," he said, "but you chiefs still don't get it." "Get what?" I asked. He turned and pointed to a chalk sign someone had written on the kitchen blackboard: "It's the first attack line, stupid."

"What's that supposed to mean?" I asked. He replied, "When are the bosses on this job going to finally recognize the first attack hoseline is the single most important firefighting action at a fire? When are you guys going to acknowledge and appreciate the first hoseline stretched at a fire saves lives, including saving lives of firefighters?"

Questions

1. Which one is not a cause of firefighter's being caught and trapped?

A. Flashover
B. Back draft-explosion
C. Disorientation in smoke
D. Stress

Answer_____

2. True or False - " Tight building syndrome" is a cause of firefighter's caught and trapped in a fire?

Answer_____

3. Which one of the following is not a result of reducing the number of firefighters responding on an engine company?

A. Slows down the speed of a hose stretch using 1 _ inch hose
B. Reduces the number of times a 2 _ inch hose is stretched
C. Reduces the number of hose lines the first responding companies can stretch
D. Reduces stress injuries to firefighters

Answer_____

4. Which one of the methods of heat transfer is most common at a structure fire?

A. Conduction
B. Convection
C. Radiation
D. None of the above

Answer_____

5. Which firefighting tactic saves more lives at fires?

A. Venting
B. Fire extinguishment
C. Forcible Entry
D. Ladder rescues

Answer_____

Answers: 1.D; 2.T; 3.D; 4.B; 5.B