APPLYING WATER SAFELY

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BY WILLIAM E. CLARK

Ever since hose was invented (in 1672 in Holland), little has changed about fire extinguishing methods. Hose and nozzles have changed, but the principles have not; and water application is not only the basis of contemporary firefighting but also a fertile source of injuries to fire service personnel.

Many of these injuries occur during interior firefighting, and there seems to be an increase in such injuries compared with 20 years ago. Perhaps there is a clue to the reason for the increase in injuries in this statement uttered by younger members of the fire service: "We use aggressive interior attack." Often they imply that this is a recent discovery. It may be to them, but it has been an established procedure for more than a hundred years in some older departments. It has become a more popular practice in the past 20 years because of the widespread use of breathing apparatus, which allows the instant transition from neophyte to blaze beater. This is further abetted by the prescribed protective clothing, which allows the wearer to enter more highly heated areas than he would without it.

So now we are faced with a paradox: The increase in injuries is a direct result of technological advances in the sophistication of equipment. If so, what are the reasons? A good way to look for the answer is to examine the difference between contemporary and older methods. There were far fewer injuries from heat in the old days even though the firefighters got in close and did the job well.

The old timers had both advantages and disadvantages compared with today`s firefighters. Their lack of breathing apparatus and protective clothing subjected them to punishment from smoke and heat but also kept them from getting into positions where opening the nozzle would result in an injurious steam bath. Their solid stream bounced off the ceiling onto the burning material without creating excessive steam, and they were able to continue advancing.

Some of the problems today come from moving into a highly heated area before opening the nozzle. The protective equipment makes this possible by reducing the discomfort on the way in.

Another influencing factor is the fact that the water sprayed from fog nozzles will create more steam than a straight stream will, and this can be dangerous. The more moisture there is in the air, the more likely it is to cause burns. Human skin can stand a dry heat of 500°F for several seconds. The same period of exposure to very moist heat could cause burns at 135°F.

Furthermore, the rapid conversion of fog into steam nullifies the natural thermal balance: The ceiling temperature is lowered, but the rest of the room is saturated with condensing steam, which may be hot enough to burn exposed skin.

Even if the skin is protected by complete coverage, the condensing steam creates a hostile environment with reduced visibility and a high level of discomfort. This situation can stop an advance and result in excessive application of water.

Although there is a notable move underway from fog to straight or solid streams, those fire officers who still insist on fog should remain aware of how to cope with problems it may cause. If 30 gallons of water are converted to steam, they will make 6,600 cubic feet of rapidly expanding steam, which has to go somewhere. With adequate ventilation, the steam can escape without harm; without it, the steam will saturate the interior. In many cases, just one open window will provide a big enough steam outlet to allow almost immediate entry of the attack team, provided that the outlet is not on the side from which they enter. Of course, greater ventilation will make entry safer (and easier).

Fog streams push a large amount of air, hot gases, and smoke ahead of the water. Straight or solid streams will, too, but to a lesser extent. A fog nozzle at 100 psi can move more air than positive-pressure fans. If streams are directed into the same floor on which firefighters are present, they may cause burns. If firefighters are trying to enter, they may be forced out. This can happen when the stream is directed through a window or when streams are aimed toward each other in a building. The air pushed ahead of a fog stream can accelerate the fire in areas the water isn`t reaching.

Another example of air accelerating fire is when the air in a hoseline is pushed out through the nozzle as the line becomes charged with water. The nozzle should be aimed away from the fire until all the air has been released; then the nozzle should be shut down, aimed at the fire, and reopened slowly. It should be opened slowly because the pressure at a closed nozzle is the same as the engine pressure (assuming no pressure change due to elevation), but as the water flows, friction loss will lower the nozzle pressure. This should be allowed to happen slowly; sudden release of pressure may wrest the nozzle out of control.

A similar situation can occur when water flow is stopped by a kink in the hose near the nozzle. The pressure at the kink then becomes full pump pressure, and that is what will hit the nozzle when the kink is released. Whenever the flow from a nozzle is accidentally interrupted, the nozzle should be shut down until water flow is restored and then reopened carefully.

One engine company was operating a hoseline in a basement when a bus stopped with its wheels on the hose in the street, thus stopping the water flow. The nozzleman had no idea what happened and just stood there holding the nozzle. When the bus moved, water flow was suddenly restored and reached the nozzle forcefully, throwing it upward and hitting the nozzleman in the mouth. Similar accidents have occurred when a burst in the hose was covered with a burst-hose jacket and the flow resumed suddenly.

Unattended nozzles should be kept closed for the same reason. There have been cases where a dry hoseline got charged by mistake and suddenly was whipping around the room because the nozzle had been left open. It also is the reason that when in the closed position, the nozzle handle is forward. Then, if the line is pulled out along the floor, the nozzle won`t open.

The proliferation of camcorders is enabling us to view fire prevention failures and tactical blunders in living color and also to see violations of the most basic safety rules. One recent tape shows two separate cases of firefighters straddling a hoseline. This brings the hoseline within dangerous proximity of those two highly sensitive spheroids that are essential components of the male reproductive system. The solution is not the mechanical quick fix of providing aluminum cup jocks but to teach safe hose handling.

HEAVY STREAMS

Experiments reported by David P. Fornell in Fire Stream Management Handbook (Fire Engineering Books, 1991) indicate that a firefighter of average size and strength can safely control a 134-inch hose discharging a 50-psi stream through a 1516-inch nozzle tip.

For many years it generally has been agreed on that two firefighters can control streams up to and including a 212-inch line discharging 320 gpm at 50 psi through a 114-inch tip. However, it is felt that this is the safe limit for handheld streams, and beyond that (master streams, large-caliber streams, or heavy streams) deck guns, deluge sets, ladder pipes, and platform nozzles are necessary. The flows of these heavy streams vary up to 1,250 gpm, generally, although a few departments have some larger nozzles.

There are three safety considerations when using heavy streams.

If the stream hits a person, it can cause serious injury.

If the stream hits a ladder or other movable object, it may knock it down. For example, a heavy stream dislodged a piece of scaffolding, which fell on a firefighter.

There is not much danger of instability with fixed nozzles, but there is with portable deluge guns.

Some departments take precautions to anchor the portable device so it can`t move. Some do not permit the nozzle to be lowered to less than 40 degrees from the horizontal. There have been deaths and injuries caused by a deluge gun`s flipping over when lowered below a safe level. Some deluge sets have a safety device to prevent the nozzle from being lowered too far, but some allow the lock to be bypassed in cases where the gun is securely mounted on permanent mounts on a vehicle.

You would think that, after using hose and nozzles for 300 years, we would have discovered a better way of manually extinguishing fire. Maybe such a discovery will be made in the future, but until then, we can try to make the job safer by using water wisely.

Suggested Reading

1. Richman, Hal. Engine Company Fireground Operations, 1991. National Fire Protection Association, Quincy, Massachusetts.

WILLIAM E. CLARK has had a long and distinguished fire service career and has long been an advocate of firefighter safety. He spent 20 years in the City of New York (NY) Fire Department, where he rose to the rank of battalion chief; he also has served as an industrial fire chief. Clark founded the International Society of Fire Service Instructors and was its president. He has served as chairman of the National Fire Protection Association committee on protective equipment and chairman of the International Association of Fire Chiefs training and education committee. He is the author of Firefighting Principles and Practices, published by Fire Engineering Books