Fire Engineering

"INTERIOR" INDIRECT AND COMBINATION ATTACKS: A MISUNDERSTANDING?

Many articles have been written explaining the different methods of fire attack and options for applying water during firefighting operations. However, to this day the debate continues, and few topics stir more emotion at the fire station kitchen table than the age-old question, "What is the best way to extinguish a fire when conducting an aggressive, interior structural fire attack?"

First, let us review the three most commonly accepted and applied methods of structural fire attack. Prior to the mid-1950s, most fire departments practiced direct fire attack using primarily smooth bore nozzles, producing a solid stream. The essence of direct attack is simple: apply water in the form of a straight or solid stream directly onto burning fuel in an effort to cool it below the point at which the fuel produces flammable vapors. The concept is very simple: If more water [gallons per minute (gpm)] is applied to the burning fuel than heat (Btus) being produced by the fire and a negative heat balance is achieved, the fire will go out. The other key factor to consider when using a direct attack is whether the water is actually reaching the burning fuel, emphasizing the importance of reach and penetration when attacking a fire using the direct method.

During World War II, Chief Lloyd Layman developed a method of fire attack using water fog to extinguish fuel-oil fires on ships. This method was developed on a decommissioned Liberty ship by Layman's forces in the Coast Guard Firefighting School. Following the war, Layman refined this method for use in structural fire attack. In 1950 at the Fire Department Instructors Conference in Memphis, Tennessee, Layman introduced this indirect method of fire attack. The premise behind the success of the indirect method of attack is the rapid production of large quantities of steam within a relatively confined environment with little or no ventilation. This method of attack was designed primarily as one to be initiated from outside, remote positions through

a window into the fire area. The indirect attack was not intended for aggressive interior structural fire attack. In fact, Layman, the father of fog firefighting, warned of the potential danger to the nozzle team if this method is applied from interior positions, because of the disruption of thermal balance and the hurricane of scalding steam produced.

Following Layman's work, Keith Royer and Floyd W. "Bill" Nelson conducted, at Iowa State University, pioneering research into the use of water fog to extinguish structural fires. Royer and Nelson introduced a variation of the indirect attack using water fog called the "combination attack." Instead of keeping the nozzle in a fixed position as in the indirect attack, the idea behind the combination attack is to "roll" the stream around the room to improve the steam conversion and the efficiency of the stream. The common factor between the two methods is rapid steam conversion by the water fog as it is injected into a superheated, well-sealed fire compartment.

As was true for the indirect attack, the combination attack was primarily designed as an exterior method of fire attack. The first priority when employing an indirect or a combination attack, as intended by its inventors, is to knock down all visible fire from the outside prior to entering the fire building. This concept was not that much different from the standard firefighting practices of the 1950s when turnout gear offered a much lower level of thermal protection and SCBA use was not as common. The only difference was that fog nozzles were substituted for the smooth bore nozzles that had been in use more than a hundred years. As turnout gear improved and SCBA use became mandatory, most fire departments routinely entered burning buildings to initiate fire attack from the inside in an effort to save more lives and property, and the misapplication of the "interior" indirect and combination attacks began.

This information is readily available from many sources, but few articles have clarified and explained the different methods of structural fire attack and their proper application as clearly as the two-part article "Little Drops of Water: 50 Years Later" by the late Andrew Fredericks.[1] These two articles (Parts 1 and 2) are probably the best, most comprehensive pieces written on the topic of applying water to fire and should be considered required reading for anyone on the business end of an attack line.

DIRECT METHOD MISUNDERSTOOD

There seems to be a great deal of misunderstanding about the most basic yet most effective and safest method of applying water from an interior position-the direct method. Some texts describe a direct attack as simply applying water directly on the seat of the fire. In its most basic form, this is correct, but it does not completely describe the direct attack. If a fire is small and localized, water can be applied directly to the seat of the fire; this will work very well and is the most efficient use of water. However, not all fires are controlled in the incipient phase. In fact, the modern fire environment is extremely volatile and produces fires that can reach flashover conditions within minutes. If a fire that fully involves a room and its contents is encountered, then the water, in the form of a straight or solid stream, should be distributed throughout the room by sweeping the ceiling and floor and rotating the nozzle vigorously in an effort to apply the water directly onto the burning fuel in the form of large droplets.

This aggressive, circular nozzle rotation is often mistaken for and described as a combination attack. You must remember the intention and essence of each form of fire attack. By definition, the direct method involves applying water in a straight or solid stream directly onto the burning fuel with the intent of cooling the fuel to eliminate flammable vapor production. It makes no difference whether the fuel is a small rubbish pile, a piece of furniture, a complete room, or fire rolling across the ceiling of the involved room or rooms and down the hall. It's still a direct attack! Just because the nozzle is swept or rotated to improve distribution and drive the fire back does not mean that the attack is a combination method, where a fog stream and massive steam production are the tools of choice. A direct attack will produce most of its steam at the fuel source, where it will be of the most benefit, not prematurely, where it would likely be carried away by heat currents and have little actual cooling effect on the burning solid fuel.

A direct method of attack with a straight or solid stream will certainly not produce steam in the quantity that will rapidly fill the fire compartment, creating an untenable environment for

the nozzle crew or any victims because of the presence of moisture with high heat and thermal imbalance. Although some deterioration of any available visibility is to be expected when operating any fire stream within a burning building, the direct attack will help maintain the visibility present prior to opening the nozzle.

As stated earlier, many fire academies teach and fire departments use (misuse) the indirect and combination methods of attack as primary methods of interior structural fire attack. One possible explanation for this misuse is the method of instruction and application taught during structural fire attack training. Many firefighters have been taught to employ these techniques during live-fire training, training that in many cases is inadequate and unrealistic. Students are taught to use a combination attack with a 30° to 60° fog stream while crouched directly outside of the burning room, which usually has a limited amount of fuel and sealed windows, allowing little or no ventilation. Under these circumstances, the combination attack will be fairly effective, even though all visibility is lost and conditions for the nozzle team become very uncomfortable. What we should be teaching is the use of the proper method of attack flowing adequate gpm coordinated with well-timed, well-placed ventilation.

If the residents of your response area are considerate enough to call you before they have a fire so you can control the amount and type of fuel burning and stretch your attack lines into a position just outside the fire room so the fire can be quickly controlled, then a combination attack may be fairly safe and effective. However, if that's not the case and your engine companies routinely enter burning buildings to battle fires against unknown, sometimes large, fuel loads and you may have to fight your way into the front door, down the hall(s), and then advance into the burning room or rooms to complete extinguishment, then a direct attack with a straight or solid stream is the most effective and safest choice. Any attempt at advancing down multiple hallways or through multiple rooms of fire using a combination attack with low to moderate gpm flow, as is being taught, would likely result in painful burn injuries for the nozzle crew and a lost fire building.

Many will argue that the majority of the fires fought across the country involve only a single room and contents and, because of inadequate staffing or poor tactics, ventilation of the fire room is often delayed. Under these conditions, an "interior" indirect or combination attack will usually be effective. However, even under these very limited fire conditions, a direct attack with a straight or solid stream and adequate gpm flow will achieve faster, more complete knockdown using less total water, resulting in less water runoff and less excess damage. The direct attack will also maintain better visibility and create less disruption of the thermal balance.

Then, there is the enemy to consider. What protection is fog stream with inadequate volume going to provide from an unexpected flashover or rapid-fire progress event? Another bit of bad information that has been taught for many years goes to the basics of how fog nozzle pattern adjustment has been taught-right to fight or right for reach and left for life, which is totally misleading. What we should be teaching is left for "lobster," because that's exactly what happens to the nozzle crew and anyone else in the surrounding area when a fog stream is injected into the superheated air of a burning structure. It is a well-known fact that a water curtain of fog is not effective for protecting an exposure, since radiant heat will penetrate through the fog stream and continue to heat the exposure. This concept holds true inside a fire building as well. This magical force field of fog will not protect you inside a burning building any better than it protects an exposure outside. The best protection from flashover or other rapid-fire progression events is to simply knock down or extinguish the fire using a direct attack with a straight or solid stream flowing adequate gpm. Fog streams used inside a burning building are more likely to burn you than protect you!

No nozzle or method of fire attack works best in every situation for every application. However, the historical documentation combined with practical experience clearly shows that the most effective and safest method of aggressive, interior structural fire attack is made using a direct attack with a straight or solid stream flowing adequate gpm. The result will be a faster and more effective knockdown of the fire and a more tenable environment for the nozzle crew as well as any victims who may be trapped within the burning building. ■

Reference

1. Fredericks, Andrew A., “Little Drops of Water: 50 Years Later, Part 1,” *Fire Engineering*, Feb. 2000, 66; Part 2, Mar. 2000, 132.

Additional References

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Fornell, David. *Fire Stream Management Handbook*. (Saddle Brook, NJ: Fire Engineering, 1991).

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