Model SOP Standard Operating Procedure

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3. ENTRY PROCEDURES INTO FIRE-INVOLVED COMPARTMENTS

Sections

1. Purpose

The following bulletin serves as a training document that covers compartment entry techniques.

The methods used are not universal but are proposed in a way that demonstrates entry techniques will vary according to fire conditions. In some situations a ventilation-controlled fire will exist with little flaming but high amounts of combustion products accumulated that are possibly in a fuel-rich state. In other situations the flaming fire may be very post-flashover and very intense. On occasions, an opposing wind may enter the building and create untenable conditions for firefighters.

In all cases the control of fire conditions will rely on an effective compartment entry technique, adequate flow-rate and a coordinated venting strategy.

2. Objectives of Compartment Entry

When arriving first on-scene at a structure fire, the fire conditions may present themselves in many ways. For example, the building may be sealed closed and no sign of fire may be apparent from the exterior, although there may be a smell of burning in the air. It may be that a window is open or has failed through heat with large amounts of smoke issuing. Alternatively, the fire may be post-flashover in some (or all) parts of the building and flames may be issuing from one or more openings. The fire may also have extended to other compartments, voids or roof spaces.

In some cases the fire will involve small residential compartments of 20m^2 or entire apartments to 100m^2 or more. In larger commercial units floor spaces floor areas may range anywhere from 250m^2 to 1000m^2 whilst larger industrial warehouses or large volume superstores may exist in excess of 10,000m^2.

A wide range of smoke and fire conditions may exist but quite simply, we are looking to differentiate between – (rough guide)

2.1 Smoke & Fire Conditions - Indicators

- Light smoke from an early stage pyrolyzing fire
- Brown smoke from a fire in a ventilation-controlled state
- Black smoke from an under-ventilated fire
- High volumes of smoke from a heavy fire load
- Fast moving smoke demonstrating a fire that is rapidly progressing towards flashover or some other event

The overall purpose of using compartment entry techniques is to take control of the fire's development by preventing the formation of fast moving smoke where an air exchange is taking place from the point of entry to the fire. Also, to cool fire gases near the ceiling and adjacent to the point of entry in an effort to reduce flashover or auto-ignition potential.

If we are able to take control of the fire from this very early stage, the prognosis for an effective outcome is much better. In all situations we should close doors where possible and isolate fire development as air-flow in freely to feed the fire. We should do this during the first vital moments as we set up our attack. As we advance inside a structure we should close all doors as we pass them in order to zone down the structure into manageable compartments. This will have the effect of cutting off fire travel behind us as well as reducing the impact of any ignitions of fire gases in the overhead.

Look at the floor plans on countless NIOSH fatal fire reports and note where fire-fighters entered without using a door entry procedure; without zoning down the fire by closing doors as they passed them, and see how many fire-fighters were then killed by sudden fire escalation that came from behind or below them. The simple action of closing a door as they passed it may well have saved their lives.

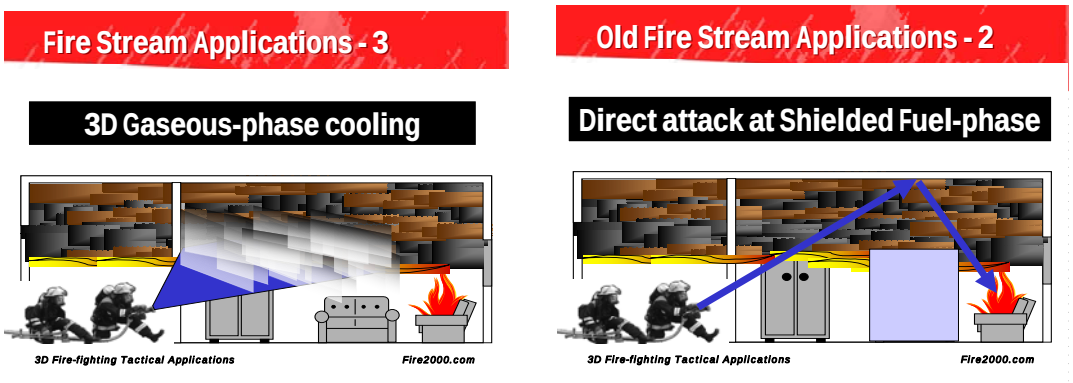
3. Residential Compartments

Smaller residential units or houses allow us to make use of finely divided water droplets, in a fog spray pattern, to control the gases as we gain entry to the structure and fire compartment itself. If our droplet pattern is effective with 6-7 bars and at least 500 LPM (125 GPM) at the nozzle we can apply short bursts of 2-3 seconds duration at the ceiling as we just crack the door a nozzle width to get the stream inside. During this operation, take a second to look in the door through this tiny opening. What do you see? Observe the smoke. What colour is it? How fast and in what direction is it moving? Is the smoke under pressure to get out or is it sucking air back in? Maybe there are even signs of fire.

Within 4-5seconds you will have applied a decent amount of water in through the opening and got a look at the conditions. Close the door and count to ten! Let the water work in the gases as it vaporizes. Then repeat the process and depending on conditions, you may want to close the door once more or make entry.

This brief 15-30 second approach is controlled. It allows you and your crew time to ensure you are together, working as a team. Take a look around during this period. Read the conditions but also get a feel for the layout of the structure. How many floors? Where are the windows? Where are the stairs likely to be? Is the fire at your level in the front of the house or the rear?

Advance in and continue to cool gases in the overhead with short bursts of water-fog. By using very small amounts of water you will effectively 'steam' the atmosphere without steaming your crew. However, where the smoke and gases are so hot that you are being enveloped in steam, even when using just small amounts of water, we may need different tactics!



By using brief bursts (2-3 second cycles) of a straight stream bounced off the ceiling you will gain some cooling effect in the overhead as the water vaporizes and the stream will break up into large droplets that may reach the firebase itself. In doing this, direct the hose stream further away from you at a 30-40 degree angle to the floor. Assess the effects and advance on.

4. Larger Commercial Units

Where floor area increases, so generally does the fire load. In effect you may need greater amounts of water so the 500 LPM (125 GPM) stream may become underpowered. Remember the basic flow formula of A x 6 which states that for every square metre of fire involvement you'll need 6 LPM to deal safely and effectively with a developing fire. This is a European formula but it matches almost exactly with the US equivalent, providing you recognise that the NFA formula is for the attack line AND a secondary support hose-line combined (the resulting NFA flow-rate should be divided by 2).

In large commercial outlets the primary attack line should flow a greater amount, in the realms of 750LPM (200 GPM) according to the levels of fire development and involvement. However, the door entry procedures remain the same and remember to zone down the compartments once inside.

5. Large Volume Structures

Similar to large commercial outlets, these lightweight steel clad structures that may have floor areas in excess of 10,000 m^2 can present tremendous challenges and dangerous hazards to firefighters. The power laws of fire spread demonstrate that these fires can rapidly develop and double in size every 30 seconds! Such fire spread is often non too obvious as the high ceilings take the smoke layer away from the floor, but in those dangerous gases at high level we have a recipe for disaster.

Suddenly the fire may cause a rippling effect in the smoke layer as it bounces up and down. This is where there is conflict with air rushing in to feed the fire and small bursts of flaming gases high up near the ceiling that aren't able to sustain themselves due to the heavy rich mix of gases existing in the overhead. However, this effect in the layer is signalling an impending event of rapid fire progress. When this occurs firefighters will become disoriented as the smoke layer suddenly drops to the floor, forced there by the expanding gases near the ceiling. This expansion is caused by a fire gas ignition and whilst the firefighters may well survive this stage, they will end in a state of panic as they become

lost in the dark smoke, unable to escape from the super-heated conditions. Their air will run out in a few short minutes as their breathing rate increases dramatically.

In these buildings there must be strict command and control and risk assessed strategies employed.

Refer to SOP 1:2008 (Tactical Deployment) for further details.

Don't get caught out with inadequate flow-rate and an uncoordinated entry to fire-involved compartments

6. High-rise Buildings

Fires involving high-rise compartments are generally of two distinct types

6.1 High-rise Fires
- Residential high-rise tower blocks with common hallways between apartments
- Office and commercial buildings, sometimes with large open-plan floors

In the first case we are faced with a situation typical of a residential fire at ground level, except there will be a clear time lag between entering the building and operating on the fire floor. There will also be communication problems where a serious fire involves large numbers of staff and resources on-scene. In the second situation we are faced with a severe problem where fire threatens to develop beyond the control of a fire-fighting force, where sprinklers are not installed, as flames spread up the outside of the structure.

In both cases there is potential for exterior winds, which are greatly magnified in their velocity and strength at height, to create blow-torching effects in common hallways servicing apartments and across open-plan office floors. These every intense fires can lead to totally different door entry procedures than those used at ground level.

In a high-rise fire, flow-rate at the nozzle is more important than high-pressure creating finely divided droplets in a fog pattern. We need to flow large amounts of water at these fires and therefore our attack methods are different. The rising main standpipes and length of hose-runs may not support adequate pressures at the nozzle. Therefore we need to revert to smooth-bore nozzles to ensure **minimum** flow-rates of 500 LPM for residential fires and 750-900 LPM for open-plan office fires. Without these flow-rates we are fighting an uphill battle against the flames, literally! If you analyse fire loads and wind effects together against needed flow-rates it soon becomes obvious why firefighters are so often beaten back by these fires.

5.1 High-rise Fires Compartment Door Entry Procedure
- Adequate flow-rate is the most important requirement
- An 80m^2 apartment requires a **minimum** of 500 LPM on the primary line
- Where exterior wind effects are blow-torching the fire the first two lines might have to share 1000 LPM (270 GPM) between them – **this is an absolute minimum!**
- The best way to ensure these flow-rates is to have a smooth-bore on the primary attack line, supported by a spray nozzle on the secondary support line

- The door entry is achieved in a similar way as above, using 2-3 second burst cycles
- If the entry cannot be gained then a 90 degree high-flow spray should be used to advance in and the smooth bore should follow in support
- Fast developing open-plan office fires may require 950 LPM off the first in nozzle!
- This may have to be deployed into the compartment from the entrance lobby/hallway due to heat and fire conditions pushing out

7. Door Entry Tactics

7.1 When gaining entry to a compartment where fire is suspected

- If open, close the door to control any inwards air-flow feeding the fire
- Door entry requires two firefighters – one on the door/one on the nozzle
- Do not open the door until the attack hose-line is effectively charged with water
- Kneel or crouch down by the door and use the door to protect you from the fire
- If the door opens away from you use a strap or rope tied to the handle to control the door opening
- Force the door and open it just enough to get the nozzle tip inside
- Make observations on the smoke volume, direction colour and velocity
- Look for fire and any occupants just inside, through the 150mm (6”) opening
- Burst a 2-3 second application of water-fog up into the overhead inside
- Observe the effects and close the door
- The entire evolution should take around 10 seconds
- Wait for 10 seconds and repeat the process again
- Be calm and controlled about this and use the time to set your crew
- If conditions permit advance inside on completion of the second evolution
- By now you will have been at the door for around 30 seconds and the interior should be ‘steamy’ on entry
- As you advance in, close all doors as you pass the in a effort to zone down the structure
- Continue to utilize bursts of water fog on a 30-50 degree fog pattern to cool fire gases in the overhead
- A secondary support hose-line should be left waiting at the entry door with crew
- The nozzle man of this line should control the opening of the door, closing it down to reduce air in-flow or opening it up to raise the smoke layer, communicating their actions to the primary attack team and optimising the door opening to best effect
- As soon as the first line has made 15m (50’) into the building the second line should also advance in, attempting to keep 15m distance apart