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Cyanide and Carbon Monoxide: The Toxic Twins of Smoke Inhalation

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photo: www.FirefighterSafety.net

SCBA MAYDAY!

by Kevin J. Reilly and Frank Ricci

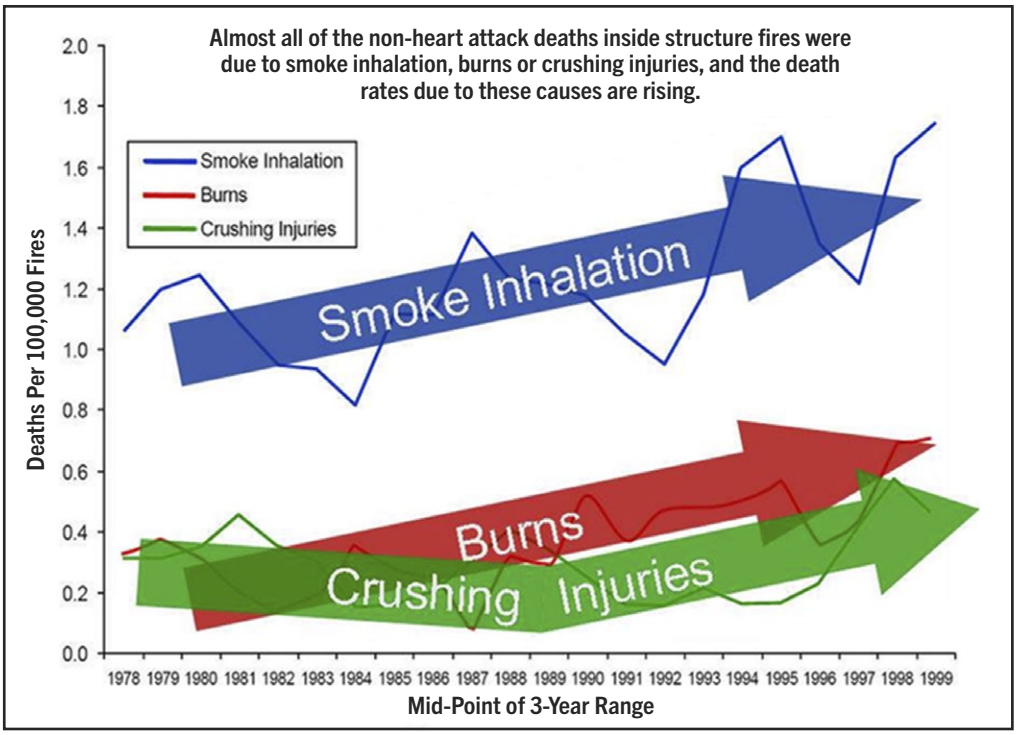
The advancement of SCBA, as well as other technologies, has made firefighting more efficient and effective. But these advances have also taken firefighters deeper into Immediately Dangerous to Life and Health (IDLH) environments. Exposure to lethal concentrations of toxic gases is a major concern, with smoke inhalation as one of the leading causes of line-of duty-deaths (LODD).

Situations are varied, and even the most experienced firefighters can find themselves in a mayday scenario. Regrettably, maydays happen, and firefighters need to be prepared for the worst with proper training. Fortunately, the stigma associated with calling a mayday is becoming a thing of the past, as firefighters are recognizing how essential it is to call a mayday as soon as trouble is realized.

During a mayday incident, there are multiple operations that happen simultaneously. These include commanding the fire, commanding the rescue, and tactical operations for the Rapid Intervention Team (RIT). Adequate staffing, proper size-up, and knowledge of building construction will serve to minimize the number of maydays.

The focus of this article is what the individual firefighter can do with self-rescue techniques during a mayday incident. Good instruction, combined with practical training, can dramatically increase the chances of surviving a mayday.

In most situations, the single most critical factor for those in need of rescue is AIR. There is no question that preparation and training with air management will increase the chances for survival.



Source: Adapted from Rita F. Fahy, Ph.D., "U.S. Fire Service Fatalities in Structure Fires, 1977-2000." National Fire Protection Association, July 2002. Used with permission.

Preparation

Preparation starts in the fire house. SCBA bottle pressure is the key to air-time longevity. During the SCBA check at the beginning of each day, bottle pressure should read full. Full means...full. Keep in mind that every 100 psi in a half-hour bottle equals approximately 8-12 breaths of air.

SCBA training typically involves everything except how to breathe efficiently. It is common to think that proper breathing technique comes naturally, but that's not usually the case. It's important to be familiar with individual limitations. There are various breathing methods that have been developed for controlled breathing. Examples of two methods that are proven to extend air time in an emergency are the Counting Method and the Reilly Emergency Breathing Technique.

The Counting Method, typically used in yoga, is accomplished by following these simple steps:

- Inhale for 5 seconds – slowly and fully
- Hold for 5 seconds
- Exhale for 5 seconds
- Hold for 5 seconds
- Repeat cycle

The Reilly Emergency Breathing Technique (REBT), also referred to as "the humming method", has performed well in medical studies and is achieved by following two simple steps:

- Inhale as you normally would in your breathing.
- "Hum" your breath out in a prolonged, consistent manner while exhaling.

In situations when a firefighter needs to disentangle his/her SCBA or rapidly move around obstacles, it may be difficult to continuously hum after each breath. In these circumstances, resume breathing as you normally would and intermittently utilize REBT. The more you use REBT, the more your survival time will increase. It is important to be familiar with individual limitations, and this is realized through practice.

There are various breathing methods that are effective to extend air supply. With appropriate research and comparisons, you can see what works best for you. Besides the obvious physiological advantages that are associated with breathing efficiently, there are psychological benefits as well. Focusing on these breathing techniques will enhance your ability to be as calm as possible.

Training

Development of a practical mayday training course is also important to ensure known protocols and processes are in place if a problem occurs. The key word here is "practical". Classroom review, although important, is not sufficient for proper or meaningful mayday training. For example, when you teach a beginner to swim, you explain how to swim and you go through the motions out of the water. But there is nothing that can replace getting in the water.

Proper mayday training must include hands-on evolutions with five basic mayday scenarios:

1. Trapped
2. Entangled
3. Lost
4. Collapse (something falls on you)
5. Fall (through floor/ roof)

The next step is to develop training props that can simulate each mayday scenario without putting the student at risk. The goal is to create a real-life experience that will trigger the mayday calling response. Props may consist of the student crawling (complete PPE, SCBA, blacked-out face piece) into a closet or small bathroom where the door is blocked and unable to be opened, simulating being in a trapped or disoriented/lost situation. A secondary prop can be a hose line coupling, which would assist in finding the way out.

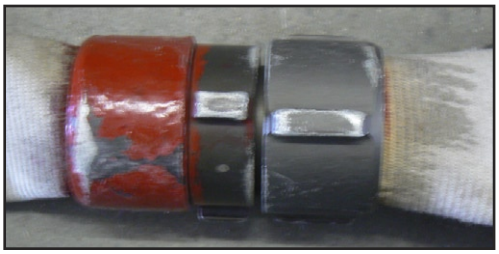


Photo: Bumps to the Pump
Source: www.FirefighterSafety.net

To simulate an entanglement, loop a wire over the student's SCBA bottle while he/she is crawling. To simulate collapse, drop a piece of chain link fence over the firefighter while he/she is crawling. Drop the crawling student into a ball pit or onto a mattress to simulate a fall.

Mayday, Mayday, Mayday!

Mayday must be communicated as soon as trouble is realized. There will be times when the firefighter or crew in trouble will have to take protective measures first, such as finding an area of refuge before transmitting the mayday.

While the circumstances will dictate your actions, there are basic guidelines for when to call the mayday:

- Medical emergency
- Trapped by fire
- Fall through floor or roof
- Building collapse
- Lost and can't find crew or lost crew member
- Trapped and can't free yourself on the first attempt
- Low on air and not near an exit
- SCBA malfunction

While this list is not all-inclusive, it all comes down to a simple catch-all rule of

photo: FirefighterSafety.net

thumb: If you think you are in trouble, you are! Call for help! Help can always be turned back. We must keep in mind the zero impact factor (the amount of time it will take for a company to make an impact on your situation). Survival is predicated on your ability to remain calm by relying on your training. Don't wait to sound the mayday. Every second delayed is two seconds (at least) that someone is not coming to help you. Activate your Personal Alert Safety System (PASS) device intermittently, but not when you are transmitting your call for help. Even if in contact with command, periodically activate your PASS device. This will give the RIT an audible target to locate you.

We recommend establishing a protocol for what information should be delivered during transmission for help – the acronym is LUNAR, which represents:

- **L**ocation
- **U**nit
- **N**ame and Nature of problem
- **A**ir Supply and Assignment
- **R**esources needed

It all boils down to WHO is in trouble (Engine 25, Firefighter Johnson), WHERE he/she is (lost on second floor, fell through floor into basement), and WHAT is the situation (out of air in closet, trapped under debris with injuries). The message must be acknowledged. An unacknowledged mayday is no different from a transmission never sent.

All firefighters should have a radio, but not everybody should talk on the radio. Radio discipline is imperative because it leaves channels available for necessary and critical communication transmissions. Members must listen to the radio so mayday calls are not missed. Fire companies not given an assignment on the fire scene should monitor the radio and track crews on their own. This will allow them to know the location of personnel and the ability to provide assistance in the rescue response if needed.

From the moment the crew enters a structure, a transition in size-up takes place. It now becomes the crew's responsibility to provide information about interior conditions and to monitor exterior operations. Periodic updates on the interior location of trapped victims and conditions are essential, especially in a mayday situation. Besides search or fire attack, communication among the crew should also be taking place to assess points of refuge in case the situation deteriorates. Moving to a place that provides refuge from heat smoke or additional collapse will increase chances for survival.

NFPA 1584. Standard on the Rehabilitation Process for Members During Emergency Operations and Training Exercises: Smoke inhalation symptoms could be indicative of hydrogen cyanide (HCN) and carbon monoxide (CO) intoxication, and immediate medical assessment should be initiated. HCN and CO gases are present in every fire. Symptoms of exposure poisoning are non-specific and easy to miss. Any firefighter exposed to HCN/CO or who presents with headache, nausea, shortness of breath, or gastrointestinal symptoms should be assessed for smoke inhalation poisoning. At an incident scene, HCN and CO exposure can be measured with a portable exhaled breath analyzer.

NFPA 1584 and screening firefighters at the scene are important for a number of reasons:

- 1584 is now an official standard.
- HCN and CO leave the blood stream quickly and usually go undetected.
- It can ease peer pressure to get checked out.
- It covers some liability issues.
- Most importantly, it save lives.

Conclusion

There are many preventive measures that can be taken to avoid a mayday situation. This starts with proper training and being familiar with the similarities that indicate a mayday scenario. Unfortunately, malfunctioning equipment or encountering the unexpected is occasionally going to happen. Academic, hands-on, and real-life training scenarios are essential for a firefighter to remain calm and focused in a mayday situation. This training will allow for instinctive reactions that save lives.

For more in-depth analysis on the mayday topic, visit: www.FireFighterSafety.net

Photo: Firefighter having his CO level checked at Yale's "Last Chance Survivability Study"