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TOXIN BUILD UP IN FIREFIGHTING OPERATIONS

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Everyone is vulnerable to a workplace hazard and firefighters are at a particularly high risk by the very nature of the work they are expected to perform. To some this is a known reality, but to many this goes against the bulletproof mindset, and they simply choose to ignore hazards which may be costing firefighters' lives.

Some hazards are being successfully reduced as personal protective equipment for the fire service has evolved greatly over the past three decades. The gear firefighters wear has become much better at protecting them from harmful atmospheres in building fires, reducing heat stress, and protecting from other injuries. However, more improvement is still needed – heat stress is still important and a problem, due to the cardiovascular strain and exertion from wearing the ensemble.

Additionally, other risks are perhaps not being adequately addressed. Over the past several years, studies and research have shown an upward trend in cancer rates in the fire service. These are rated as much as 150% to 200% higher than a firefighter's peers. Also, these cancers are appearing at a younger age than in the general population. This is the issue that I would like to address in this article, and provide information and suggestions to assist in reversing this trend.

A bit of history is warranted first, to explain why some practices exist that aren't necessarily the best. In the 1960s and 1970s, self-contained breathing apparatus became available to the fire service. This equipment was uncomfortable to wear and expensive to purchase; often getting a refill for the air cylinders cost money or was very time consuming. These factors

and a sometimes macho attitude did not aid in adding effective respiratory protection for the fire service. As a result, the breathing apparatus was only used as long as absolutely necessary. As soon as the bulk of the fire was extinguished, it was very common for firefighters to remove their SCBA mask and work with no respiratory protection. They weren't ignorant; this was just accepted as the norm. They were doing things as it had always been done and as they were taught. This practice still persists in some areas today.

This secondary phase of firefighting – called overhaul – consists of opening walls and ceilings to locate hidden fire, extinguishing smoldering fuels, and removing burned materials from the interior of the building. Unfortunately, the contents and



materials in residences have changed dramatically over the years. Furniture and home décor went from natural materials and solid wood to pressed wood, synthetics, and polymer-based components. When these fuels break down during a fire and while smoldering, the number of toxic gases produced is numerous. Carbon monoxide, hydrogen cyanide, benzene, acrolein, and halogens are just a few. All smoke encountered at fires contains, at a minimum, nine class 1 carcinogens. Also, the toxins in soot and ash produced by these fuels can be absorbed through the skin. Working in this environment without appropriate protective gear, including respiratory protection, may subject firefighters to toxic exposure levels.

Let's review the products of combustion and their effects on the body. The things that cannot be seen, carbon monoxide and hydrogen cyanide, are the major players in smoke inhalation injuries and deaths in civilian fire victims. A firefighter not wearing an SCBA during fire attack or overhaul is being exposed to both of these gases, among many others. These things that cannot be seen tend to do acute damage. If you talk to firefighters who have performed overhaul or even fire attack without respiratory protection, they will often report having a headache the next day or even having a feeling similar to a hangover.

The products of combustion that can be seen, like soot and ash, typically contribute to chronic or latent problems such as cancer. If a firefighter's PPE is not cleaned after becoming soiled, these materials continue to be absorbed through the skin, leading to an additive effect or possibly even a synergistic effect as the materials combine. Also, due to the construction of firefighter PPE, currently there is no way to prevent these solids from getting inside of the gear. It is imperative that firefighters not only wash their turnout gear, but also shower as soon as possible and change their uniform or clothing worn under their gear. Research has shown that the neck area is the most absorbent on the body. This area is also the least protected from soot and ash in the firefighter PPE ensemble. (A portion of the PPE ensemble, called a hood, covers the ears, scalp, throat, and neck. Hoods are now being introduced that limit the amount of contaminants reaching the skin, with a two to three times increase in cost).

Popular culture has encouraged the viewpoint of the dirty or "salty" firefighter. Most images today, even those in fire service product ads, show firefighters in dirty gear, with soot-covered faces. There is a commendable push in the fire service for this trend to

stop, to encourage a change of habits. Unfortunately though, some firefighters see dirty unwashed gear as a badge of honor and sooty faces as a sign of being a hard worker. This is part of a cultural change that will need to occur. An anonymous survey in a larger county department in the state netted some interesting results.

- 90% reported having a headache or "hangover" feeling on the day after a fire, to include black soot-filled phlegm.
- 50% to 60% have never washed their turnout gear in the last year (NFPA recommends a minimum of every six months).
- 90% were less than diligent about washing their gear after contamination.

The fire service has a tradition of cleanliness for apparatus and stations. This tradition can be used to help educate about the importance of cleanliness for PPE and yourself. Exposures cannot be eliminated, but they can be reduced. A lot of departments have washer extractors, but for some this is cost prohibitive. Other agencies have been able to fund a second set of PPE, so that a dirty set can be swapped out after a fire. Unfortunately, for many places this is also cost prohibitive.

Many years of research are ahead to determine changes to PPE to better prevent these hazards. In the meantime, some best practices can be adopted and encouraged to reduce the potential impact of them. With knowledge comes the power to solve.

A list of best practices and items to address within your agencies would include:

- Store gear outside of the apparatus bay, especially if vehicle exhaust systems are not utilized.
- Do not run apparatus or small engines in the bay if at all possible.
- Encourage cancer screenings; some local healthcare systems may assist with this free of charge.
- If you provide wellness checks or physicals, educate the physician on the aspects of firefighter cardiovascular health and the risks of cancer. If you do not provide physicals, encourage your department's members to educate their personal physician on these same hazards of firefighting.



- Ban firefighter PPE from all living areas of the fire stations. If it is to be used in a classroom setting, it should be clean first.
- Set policies or guidelines to decontaminate firefighter PPE while on scene. This can be performed with a scrub brush, dish soap or simple green, and a garden hose. Dirty gear should be removed while wearing medical gloves. Use wet wipes to wipe inside of SCBA mask and inside of helmet as well.
- Set policies about department members taking their gear into their own home. If it is transported by personal vehicle, require that all possible steps to reduce contamination are taken.
- After a fire, firefighters should shower and change uniforms as soon as possible. These showers should be at least five minutes in the warmest water that the firefighter can stand. The soap used should not contain moisturizers. For off duty or volunteer firefighters, encourage carrying an extra set of clothes they can change into before going home.
- When firefighters go to a rehab area at a fire scene, their PPE should be removed. Studies have shown that it offgases for up to 45 minutes. Anytime decon of the gear is not possible, the gear should be allowed to air out for at least 45 minutes.
- When firefighters go to rehab, provide some form of wipe for them to clean their hands, face, and neck area before drinking or eating.
- Consider a program where all firefighter hoods are exchanged on the scene of a fire for clean ones. The dirty ones can be washed as a lot and become the spares for the next incident.
- Encourage washing of firefighter PPE (head to toe) and SCBA based on manufacturer's recommendations after becoming soiled. If your agency does not have a washer extractor, check with surrounding jurisdictions that you could possibly partner with.
- Work toward an ability to perform air monitoring on the fire ground for carbon monoxide and hydrogen cyanide.
- Set policy for mandatory SCBA use throughout fire attack and overhaul at structure fires, vehicle fires, and dumpster fires. As long as visible smoke is present, SCBA is to be used. Once

visible smoke is gone, then air monitoring can be used to determine SCBA use. If air monitoring is not available, then SCBA must be used.

- Develop a firefighter specific health and wellness program, with a focus on cardiovascular conditioning.
- Set policy requiring that chief officers and fire investigators (if your agency has them) wear appropriate skin and respiratory protection while investigating, post fire.
- Encourage the washing of dirty uniforms or clothing worn under turnout gear, at the fire station.
- Utilize a turnout gear inspection program based on NFPA 1851.

Understandably, change will not happen overnight. We first have to recognize that there is a problem and then we can work together to address the issues and move forward, doing what we can to protect our employees while still equipping them to effectively perform their jobs. Enforcement of policy alone will not be a suitable solution. Education at supervisory level and individual level will be key. There may well be other practices and recommendations that would also address these hazards. If so, hopefully this can open up a dialogue to share best practices so that we can keep our employees healthy and safe today, tomorrow and even years down the road.





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This Month:

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