

# **BEST PRACTICES FOR REDUCING FIREFIGHTER EXPOSURES TO CARCINOGENS**

A “Best Practice” is a technique that identifies a standard way of doing something that multiple organizations can use and adopt. Many departments across the nation are beginning to implement best practices to reduce exposures to carcinogens. Based on findings from the University of Arizona study, along with other research, Tucson Fire is implementing a series of best practices. These will be measured for effectiveness through “biomarkers of exposure” (urine, blood, buccal cells).

The interventions involve cleaning of gear, transport of contaminated gear and placing first in engineers on air. It is recognized that doing all of these things can pose logistical challenges. The idea is that we begin to do these things whenever practically possible to help reduce exposures. Reducing the risk involves taking a comprehensive, multi-step approach. It is likely that accumulation of low levels of exposure over time (chronic effects) leads to the higher incidence of cancer in firefighters. Every step you can take to minimize your risk will help. The goal is not only to get everyone home safe, but also enjoy your retirement with your loved ones.

# ENGINEERS ON AIR

The study conducted by the University of Arizona found that Engineers often had elevated levels of PAH's in their urine post fire. PAH's are Polycyclic Aromatic Hydrocarbons, some of which are known to be carcinogenic. It is assumed this is due to the lack of respiratory protection. First in engineers, operating at the pump panel, aerial or securing utilities are often without air packs. As soon as practical, engineers should be removed from the scene and exposed to smoke.

## Why not a cartridge Filter?

Cartridge Filters may not filter out all of the potential toxins encountered at a fire (A U of A study actually found formaldehyde break through with previous cartridges) . More information on cartridge filters limitations can be found here:

[https://www.osha.gov/dts/shib/respiratory\\_protection\\_bulletin\\_2011.html](https://www.osha.gov/dts/shib/respiratory_protection_bulletin_2011.html)



**UNIVERSITY OF ARIZONA FINDINGS:**



# Elevated Hydrocarbons



## 1-Naphthol

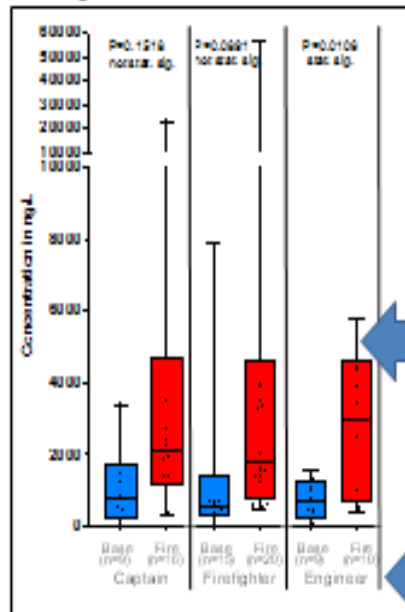
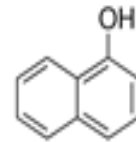


Figure 1: Concentration of 1-Naphthol in samples of urine collected before and after structure fires

- Concentrations of PAH-OHs in urine are used as an indicator of exposure
- Concentrations of 1-Naphthol in urine post-fire were elevated to similar levels in the urine of Engineers compared to Firefighters and Captains, despite Engineers not entering the structure

The University of Arizona Cancer Study found 1-Naphthol (One type of PAH) in elevated levels post fire vs baseline urine, despite engineers not entering the structure. These are indicators of exposure that can have cumulative effects over a career.

# WASH-DOWN ON SCENE

*Prior to removing the firefighting ensemble worn in the hot zone, a gross wash-down shall be performed to remove potentially harmful contaminants*

**Wash-down:** Members should brush large debris first, and then spray each other with water to remove loose particulates from turnouts and equipment. A study published in the Journal of Occupational and Environmental Hygiene found that 2 minutes of brushing with Dawn soap and water removed 85% of PAH's from the turnout ensemble. Each EC will be provided with a bucket, 2.5" to green line reducer, brush, hose, nozzle and Dawn soap to help facilitate (Dawn soap works well on the turnouts and is good at removing hydrocarbons). This is not a drenching of the gear, just a **quick two minute rinse** that can help reduce secondary exposures. Fatigue, heat or other factors may not make this step possible, and the condition of the firefighter at the time should be taken into account. IF this step is not completed, the turnouts should be taken off in the rehab area.





**Source:** Kenneth W. Fent, Barbara Alexander, Jennifer Roberts, Shirley Robertson, Christine Toennis, Deborah Sammons, Stephen Bertke, Steve Kerber, Denise Smith & Gavin Horn(2017): Contamination of firefighter personal protective equipment and skin and the effectiveness of decontamination procedures, Journal of Occupational and Environmental Hygiene, DOI: 10.1080/15459624.2017.1334904

## WASH-DOWN ON SCENE



The booster reel can also be used, but this should be low pressure water and not from any pumper that has been used for an extended period, as the water can get very hot.

Continue to wash off your neck, face, arms, legs or anywhere else you can see contamination. Hand wipes can be used in the absence of soap and water. Shower as soon as possible upon returning to the station. If possible, *shower*

***within an hour!***

# **TRANSPORTATION OF CONTAMINATED GEAR**

**We need to embrace a clean cab concept. This means treating the products of combustion the same as we would any other biohazard. Contaminated hose, tools, SCBA's or any other contaminated equipment should be decontaminated on scene or transported in a manner as to not contaminate the cab of the truck. If an SCBA's or other equipment cannot be decontaminated on scene, equipment should be bagged and transported in a compartment, crow's nest or by an EC/BC/RE.**





## **TRANSPORTATION OF CONTAMINATED GEAR**

**Clear plastic bags will be carried by each EC so that gear can be bagged and easily identified. Fire hose or any other dirty gear should be bagged or transported separately from the cab. Upon arrival back at the station, open the bags outside the bays and allow to “off gas” as long as possible.**

- *Wash all contaminated gear, making sure to use gloves and eye protection*
- *Don't forget to scrub your boots!*
- *Gloves present a challenge, but should be washed by filling up a sink with warm water and mild detergent (small amount of Dawn or Joy will work), and then putting the gloves on and scrubbing back and forth. Put a pair of EMS gloves on while you do this. Make sure the water is less than 105 degrees.*
- *Helmet pieces can be hand washed as well utilizing mild soap and water. Separate liner pieces and wash with a soft bristle brush.*
- *Don't forget your SCBA facepiece!*



*\*\*While the "gross decon" can remove 85% of the contaminants, wash your gear in the extractor as soon as possible. Request help and offer help from your reliefs to facilitate washing and drying of turnouts\*\**

## PROPER CARE AND MAINTENANCE OF STRUCTURAL FIREFIGHTING GEAR

Structural firefighting gear (turnouts) are highly engineered to keep you as safe as possible. Wearing the turnout ensemble routinely for calls other than what it is intended for can reduce the protection factor and intended lifespan of the gear.

Additionally, improper laundering, drying and storage of turnouts can damage turnouts and may not remove the contamination. NFPA 1851 and manufacturer guidelines should be followed:

- *Turnouts should be washed in front loading department extractors (washing machines) ONLY utilizing the approved automatic detergent dispenser. Do not add Tide or other types of detergents and never launder in RESIDENTIAL WASHERS!*
- *Turnouts should never be dried in direct sunlight or in a dryer that exceeds 105 degrees. UV light damages turnouts.*
- *Separate the outer shell and inner liner. Outer shells and inner liners are washed separately. Fasten all closures (zippers, pockets, etc). Turn pants and coats inside out.*
- *DRD and suspenders should be removed and washed separately or hand washed. Soaking prior to washing is also beneficial.*

# FIREFIGHTING HOODS

Recently, the firefighting protective hood has been studied as a potential route for exposure. A study conducted by the IAFF found that small particles are able to penetrate the traditional hood. Tucson Fire Department currently has 60 first generation hoods issued to firefighters as part of the study that contain a “particulate barrier” that can block the small particulates that the traditional hood cannot. The results of a pilot burn conducted by Tucson Fire and the University of Arizona were inconclusive about the effectiveness of the hoods in regards to PAH’s found in the urine post fire. The effectiveness of new generation hoods is being studied elsewhere.

A new edition of NFPA standard is due out soon which will list a particulate blocking hood as an option, but not a requirement as more study is needed to prove the effectiveness. The Safety Team will be monitoring the results of our study as well as other current studies to help guide future decisions regarding a hood design.



Trial hood currently  
worn by Tucson Fire  
members with  
particulate barrier

# HEALTH AND WELLNESS

While the main focus is on reducing our fireground exposures, there are many modifiable risk factors involving health and wellness that should be employed as well. Multiple studies have shown increased cancer rates associated with lack of exercise, obesity, tobacco use, excessive alcohol use and poor sleep habits. Tucson Fire has a team of Peer Fitness trainers, Well America and the University of Arizona as resources:

- Dr. Wayne Peate and the staff at Well America provide a full annual physical including cancer screenings, and now a full body dermal scan.
- Registered Dietician Ilene Yalen on staff as a resource for nutrition.
- Peer Fitness trainers listed at each station to help you achieve fitness goals, injury prevention and maintaining fitness for duty.
- University of Arizona sleep study and best practices
- Dr. Patricia Haynes on staff as a mental health and sleep expertise resource.

Maintaining a healthy weight, fitness levels, sleep habits, alcohol in moderation and zero tobacco are “best practices” for cancer reduction. Contact the Tucson Fire Department Safety team to help achieve your health and wellness goals and reduce your risk profile for cancer.

# RESOURCES

This document is meant to be a “living document”, residing in the station and updated as more research, advancement and innovation becomes available. As mentioned, this is an approach to implement change to the culture which can reduce our cumulative exposures. There are challenges and limitations, but this is a necessary change that can positively impact your career and retirement. We will begin to gather more urine and blood to measure the effectiveness of the interventions over the next year. The partnership with the University of Arizona and funding from FEMA for this study is invaluable, as is your commitment. Thank you.

Please contact the Cancer Research Team with any questions, comments or concerns:

***Deputy Chief Dan Burke, Chief Darin Wallentine, Captain John Gulotta, Captain Paul Moore***

Additional Resources:

<https://www.ffccs.org/> - Link to the U of A/ TFD Cohort Study.

<https://firefightercancersupport.org/>

<https://www.cdc.gov/niosh/firefighters/pdfs/FAQ-NIOSHFFCancerStudy.pdf>

[http://wscff.org/?zone=/unionactive/view\\_page.cfm&page=Healthy201n20Healthy20Out](http://wscff.org/?zone=/unionactive/view_page.cfm&page=Healthy201n20Healthy20Out)



