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Cancer – The Current Epidemic in the Fire Service

More firefighters have been diagnosed with cancer in the last two years than in the previous 10 years combined. One in three firefighters will die of cancer. There's a minimum of nine Group 1 carcinogens in all fire smoke. All smoke is hazardous and potentially lethal at high enough concentrations. These dangerous carcinogens can enter the firefighter bodies through absorption through the skin.

Firefighters are significantly more likely to develop multiple types of cancers compared to the general public. Below are examples:

Known Firefighter Cancers

- Testicular cancer (2.02 times greater risk)
- Mesothelioma cancer (2 times greater risk)
- Multiple myeloma cancer (1.53 times greater risk)
- Non-Hodgkin's lymphoma (1.51 times greater risk)
- Skin cancer (1.39 times greater risk)
- Malignant melanoma (1.31 times greater risk)
- Brain cancer (1.31 times greater risk)
- Rectum cancer (1.29 times greater risk)
- Prostate cancer (1.28 times greater risk)
- Buccal Cavity/Pharynx cancer (1.23 times greater risk)
- Stomach cancer (1.22 times greater risk)
- Colon cancer (1.21 times greater risk)
- Leukemia (1.14 times greater risk)
- Breast cancer (6 times greater risk, preliminary study results from SFFD 2013)

Types of chemicals found during firefighting, overhaul and investigation:

Cancer Type	Examples of substances or processes
Bladder	Aluminum production, rubber industry, leather industry, textile industry, prolonged exposure to benzene compounds in burning debris and soot.
Brain	Formaldehyde, benzene, vinyl chloride, acrylonitrile, (AKA – Vinyl cyanide)
Colon	Asbestos, PAH's, acrylonitrile, and formaldehyde
Larynx	Asbestos, isopropyl alcohol, wood dust
Liver	Arsenic, acrylonitrile
Leukemia	Benzene, soot, PAH'S, vinyl chloride, acrylonitrile, formaldehyde
Lymphatic & Hematopoietic	Benzene, ethylene oxide, herbicides, radiation
Lung	Arsenic, asbestos, beryllium, cadmium, coke oven fumes, chromium compounds, coal gasification, nickel refining, foundry substances, radon, soot, tars, silica, vinyl chloride, diesel exhaust.
Mesothelioma	Asbestos
Nasal Cavity and Sinuses	Formaldehyde, isopropyl alcohol manufacture, mustard gas, nickel refining, leather dust, wood dust
Pharynx	Formaldehyde, mustard gas
Skin	Arsenic, coal tars, mineral oils, sunlight
Soft Tissue Sarcoma	Chlorophenols (commonly used as pesticides, herbicides, and disinfectants). PCP's, i.e. wood preservatives

Absorption of dangerous chemicals and contaminants due to wearing inadequately cleaned PPE or PPE which doesn't effectively block dangerous particulates from the skin is one of the industries primary concerns for today's firefighters. Adding to this problem, for every 5 degrees your body temperature rises your skin absorption rate increases 400%. Below is a chart which shows skin absorption rates for toxins for various parts of the body.

Skin Absorption Rates of Toxins

(Dr. Stuart Baxter, Jan. 22, 2009 – UC Seminar)

Groin Area	300%
Jaw Angle	93%
Forehead	43%
Scalp	25%
Back	12%
Forearm	7%
Palm	6%
Ankle	3%

As can be seen from Dr. Baxter's research, 3 of the top 4 highest skin absorption areas on the human body involve the head and neck area. Currently this is the only area of firefighter's PPE ensemble not protected with a moisture barrier. One of the primary reasons for not incorporating a moisture barrier in flame resistant hood PPE worn by firefighters is the concern with the heat stress. Currently flame resistant hoods without moisture barriers have excellent breathability allowing body heat to escape through the scalp reducing the firefighters core temperature and the dangers of heat stroke. Additionally today's firefighting hoods are made from flame resistant knit fabrics which have superb stretch and recovery properties allowing the hoods to be stretched over SCBA masks to form a comfortable seal around the mask and mask hardware. If a moisture barrier were to be added to the hood fabric most of the stretch and recovery characteristics would be eliminated.

PGI has developed a new line of fire fighting hoods we've named Cobra™ BarriAire™ which incorporates a proprietary Particulate Barrier fabric which we've strategically located in areas which have the greatest risk of exposure to the firefighters - the neck and jaw. These hoods maintain the exceptional stretch and recovery properties of our regular hoods allowing them to interface seamlessly with SCBA masks and mask hardware. Additionally, the Particulate Barrier fabric is extremely supple and lightweight weighing only approximately .5 oz./sq. yd. – making it barely detectible. The fabric also has excellent breathability maintaining the comfort currently only attainable by hoods without a Particulate Barrier and allows body heat to escape around the neck and head reducing the likelihood of heat stress.

Cobra™ BarriAire™ hoods were developed in an effort to reduce firefighter exposure to potentially dangerous and toxic particles routinely encountered while on a working call. Particles can range from asbestos to drywall dust, but the largest contributor of particulate contamination at the fire scene is carbon particles from incomplete combustion of organic substances – also known as soot. Soot particles absorb and hold fire gases, making them more dangerous than plain carbon. While many particles are visible, many are submicron sized and can easily penetrate the porous surface or gaps in hood PPE. PGI's Cobra™ BarriAire™ hoods have been designed to block more than 95% of particles below 1 micron in size in the key neck and jaw areas. Penetration of dangerous particulate to the skin will be greatly reduced or eliminated substantially minimizing the chance of toxic carcinogens being absorbed into the body. Additionally, the Particulate Barrier enhances thermal protection performance (TPP) of the hoods giving you precious additional time you may need to get out safely.

Soot – Once considered the firefighters “Badge of Honor”

Many firefighters consider having a set of dirty turnouts as a “Badge of Honor”. Toxins that a firefighter comes into contact with are found in soot and trapped within the fibers of soiled PPE ensemble and ensemble elements or absorbed into the materials themselves. Contact with the soiled PPE ensembles and ensemble elements greatly increase the risk of the contaminants being introduced into the body. Many of the toxins which lead to health risks are being carried away from the fire scene on the firefighters PPE potentially exposing their fellow firefighters or family members. Soot is a group-one carcinogen and a top cancer-causing agent. When firefighters sweat and their pores open up soot gets sucked into the body through the skin on their faces, hands and under their gear. Firefighters should meticulously wash their entire body and PPE ensembles and ensemble elements after every “working job” to remove soot and other toxic residues.

Additionally firefighters should take baby wipes or some sort of rescue wipe to the scene and remove as much soot as possible from their head, neck, jaw, throat and underarms while at the scene.

Keep your PPE Ensembles and Ensemble Elements Clean

NFPA 1851 Appendix A

A.5.1.1

The importance of maintaining the cleanliness of ensembles and ensemble elements **SHOULD NOT BE UNDERSTATED**. Soiled or contaminated ensembles and ensemble elements are a hazard to firefighters because:

Oils and contaminants can be flammable, toxic or carcinogenic and can expose firefighters to toxins and carcinogens that enter the body through ingestion, inhalation or absorption. (Repeated small exposures to some contaminants can add up over time and cause health problems.)

5.3.1 Every 12 months, at a minimum, elements that have been issued, used, and are soiled, shall receive advanced cleaning.

- Toxins that a firefighter will come into contact with are found in soot and trapped within the fibers of soiled ensembles and ensemble elements or absorbed into the materials themselves.
- Contact with the soiled ensembles and ensemble elements increase the risk of the contaminants being introduced into the body.
- Many of the toxins which lead to health risks are being carried away from the fire scene on PPE used by the firefighters.
- Store in Plastic Tupperware Box that can be sealed.
- Only justification for black gear is it hides the dirt well. Black will radiate heat.
- Contaminated gear can conduct electricity.
- Contaminated gear is more likely to be flammable.

Cleaning Requirements/Procedures for PPE: Routine Cleaning

Perform the following steps after each use:

- Brush off debris
- Rinse w/water
- Lightly scrub item w/ soft bristle brush, if needed
- Inspect Item
- Clean again if necessary

Procedures for machine washing – Should be an extractor front loading type machine to limit damage caused by top-loading machine agitators.

1. Do not overload the machine
2. Pre-Treat if necessary
3. Turn hood or garment inside out and place in a mesh laundry bag
4. Wash temperature not to exceed 105 degrees
5. Add detergent – w/ PH of not less than 6.0 and not greater than 10.5
6. Run one complete cycle, rinsing at least twice
7. Dry the elements
8. Inspect and rewash if necessary
9. If the machine is to be used for other than protective ensemble element rinse out machine by running while empty through a complete cycle with 120 degrees to 125 degrees water and detergent
10. Do not use Chlorine bleach or chlorinated solvents
11. Wash with like items – other knit hoods or knit base layers only
12. Never wash FR PPE with non-FR elements

Drying Procedures

Air Drying Procedure

1. Place elements in an area with good ventilation
2. Do not dry in direct sunlight

Machine Drying Procedure

1. Do not overload the machine
2. Fasten all closures
3. Turn hood or garment inside out and place in mesh laundry bag
4. If the dryer has a no-heat option, use it
5. If heat must be used, the basket temperature shall not exceed 105 degrees.
6. If heat is used, remove garments before they are completely dry

Always Wear FULL PPE on **ANY** Fire Scene, INCLUDING your SCBA from Fire....THRU OVERHALL!

13 Steps to a Safer Department

1. Use SCBA from initial attack to the finish of overhaul.
2. Do gross field decontamination of PPE to remove as much soot and particulates as possible – Hosing off your turnouts as well as yourself (body) before you leave the scene.
3. Use baby wipes or some sort of rescue wipe to remove as much soot as possible from your head, neck, jaw, throat, underarms and hands immediately, while still at the scene.
4. Change your clothes and wash them immediately after a fire.
5. Shower thoroughly after a fire.
6. Clean your PPE gloves, hood and helmet immediately after a fire. Have a 2nd set of PPE to use while your dirty ones are being cleaned.
7. Do not take contaminated clothes and PPE home or store it in your vehicle. (Get a hermetically sealed case to store dirty gear).
8. Decon interior of fire apparatus after each incident.
9. No bunker gear in living or sleeping areas.
10. Properly store gear when not in use.
11. Use sunscreen or sun block.
12. Take steps to stop tobacco use.
13. Get Annual Physical.