

Title: Is Your On-scene Rehab and PPE Care Sufficient to Reduce Cancer Risk?

Submitted: September 2018

Time Required: 2 – 3 hours

Teaching Materials:

- Computer
- Projector or Television
- PowerPoint® Presentation

References:

<https://www.firechief.com/2016/09/15/skins-role-in-firefighter-rehab/>

<https://www.firerescue1.com/firefighter-safety/articles/2154096-Firefighter-research-shows-PPE-exposure-risk/>

<https://www.firerescue1.com/fire-products/Personal-protective-equipment-ppe/articles/359873018-Fireground-environment-not-turnout-gear-provides-carcinogen-exposure-risk/>

<https://www.firerescue1.com/fire-products/Personal-protective-equipment-ppe/articles/383958018-Decon-alley-5-steps-to-doffing-firefighter-PPE-before-rehab/>

<https://www.firerescue1.com/Personal-Protective-Equipment-PPE/articles/389876018-Fla-firefighters-get-decontamination-kits-to-fight-cancer-risk/>

<https://www.firerescue1.com/fire-products/fire-rehab/articles/1348025-Understanding-firefighters-and-cancer>

<https://www.firerescue1.com/fire-products/fire-rehab/articles/3010918-Future-of-firefighter-cancer-research>

<https://www.station-pride.com/2017/03/28/the-real-cancer-in-your-gear/>

<https://www.fireapparatusmagazine.com/articles/print/volume-23/issue-3/features/ppe-manufacturers-help-protect-firefighters-from-cancer-causing-particulates>

Motivation: A growing body of research from around the world is concluding that firefighters are at a substantially increased risk of developing certain types of cancer. Current research is now focusing on best practices to reduce or eliminate this risk, with an emphasis on preventative actions by the department and individual firefighter.

Student Performance Objective: The student will be able to identify the possible causes of firefighter cancer, proper PPE, rehabilitation at the scene and decontamination procedures.

Enabling Objectives:

- The student will be able to identify the causes and symptoms of cancer
- The student will become familiar with possible cancer risks of burning building materials and furnishings
- The student will be aware of increasing risks to responding personnel
- The student will be able to determine the best option for minimizing personal risk
- The student will be exposed to current research and differing trains of thought in reference to PPE contamination/decontamination
- The student will be better prepared to assist their department with implementing or modifying S.O.P.s concerning proper handling of contaminated PPE

Overview:

A. WHAT IS CANCER?

SLIDE 4

Cancer occurs when abnormal cells divide without control and are able to invade other tissues. This is usually caused by damaged DNA, which regulates growth in normal cells.

This may result in a mass of cells, or a tumor developing. They can be either benign (non-spreading, non-cancerous) or malignant (cancerous).

There are more than 100 different types of cancers. Most are not deadly, but of the estimated 1.6 million cases of cancer discover each year, over 575,000 will be fatal to the patient.

B. RISK TO FIREFIGHTERS

1. Exposure Risks (Inhaled or Absorbed)

SLIDE 5

- a. Vehicle Exhaust
- b. Soot
- c. Smoke
 - i. Contains minute particles of unburned carbon
 - ii. Easily infiltrates fabric layers of PPE
 - iii. Carry toxic gases
- d. Chemicals
 - i. Building materials and furnishings
flashover 50 times faster than materials 50 years ago
 - ii. Duke University study (2012) found that 85% of furniture was treated with flame retardants that are potentially toxic
 - a. Polybrominated Biphenyls
 - 1. Affinity to attach to fat/lipid cells in the body
 - 2. Every 5 degree rise in body temperature increases absorption rates by a whopping 400 percent
 - b. Chlorinated Tris (banned from children's clothes)
 - c. Penta BDE (now globally banned)
 - iii. Underwriters Labs found burning furniture produced carcinogens such as:
 - a. Benzene
 - b. Chromium
 - c. Polycyclic aromatic hydrocarbons
 - d. Formaldehyde
 - iv. Risk from the increased use of soybean oil in furniture is currently unclear
- e. Some researchers now saying that the chemicals and materials used in the manufacture of turnout gear may be another significant source of exposure.
 - i. PFOA is utilized in the manufacture of PPE
 - ii. European Chemistry Agency has firefighter PPE on their list for restrictions due to being a Substance of Very High Concern.

SLIDES 6, 7, 8, 9

2. Abnormal/Elevated Levels of Cancer Among Firefighters

- a. **Testicular** 2.02 times the risk
- b. **Mesothelioma** 2 times the risk
- c. **Non-Hodgkin's Lymphoma** 1.51 times the risk
- d. **Multiple Myeloma** 1.53 times the risk
- e. **Prostate** 1.28 times the risk
- f. **Skin Cancer** 1.39 times the risk
- g. **Brain Cancer** 1.31 times the risk
- h. **Colon Cancer** 1.21 times the risk
- i. **Leukemia** 1.14 times the risk

3. Signs and Symptoms

SLIDE 10

- a. Appetite loss
- b. Blood in the stool
- c. Blood in the urine
- d. Cough that doesn't go away
- e. Extreme fatigue
- f. Fever that doesn't go away
- g. Lump in the neck, testicles or breast
- h. Night sweats
- i. Skin changes
 - i. Spots
 - a. Get bigger or thicker
 - b. Change color
 - c. Has an oddly shaped border
 - d. Is larger than a pencil eraser
 - e. Crusts or scabs over and doesn't heal
- j. Swollen lymph nodes
- k. Trouble swallowing
- l. Shed pounds without trying

C. 2014 ARTICLE IN THE "ANNALS OF OCCUPATIONS HYGIENE" SLIDE 11

- 1. Tests Conducted by Illinois Fire Service Institute and NIOSH

2. Polycyclic aromatic hydrocarbons (PAHs) present in firefighters after fire suppression and overhaul activities
3. The most likely route of entry was determined to be the neck (hood) or inhaled or absorbed while doffing gear that was off-gassing contaminants.
 1. Off-gassing (also known as out-gassing) refers to the release of airborne particulates or chemicals—dubbed volatile organic compounds (VOCs)—from common household products. Potential sources of off-gassing range from construction materials to carpeting, cabinetry, furniture, paint, and any number of household goods. Some of the most common chemicals off-gassed from household items include formaldehyde, benzene, ammonia, and toluene.

D. INTERNATIONAL ASSOCIATION OF FIRE FIGHTERS INFILTRATION TEST

SLIDES 13, 14, 15, 16

1. Performed at Research Triangle Institute in January 2018 utilizing Department of Defense Fluorescent Aerosol Screening test on full turnouts including SCBA
2. High-level concentration of silica powder laced with a tracer with particle size approximately 0.1 to 10 microns (smoke particles are about one hundred thousandth of an inch or .25 microns)
3. Particles blown at test subject for 30 minutes at 10 mph
4. Large exposure occurred in the face and neck area not covered by the face piece and on the calves above the boot line
5. Smaller exposure occurred through the front closures, between the pant and coat, and between the gloves and coat

E. TAKING A PROACTIVE APPROACH

1. Firefighter Rehab
 - a. Rehab requirements outlined in **NFPA 1584: Standard on the Rehabilitation Process for Members During Emergency Operations AND (*highlight added*) Training Exercises**
 - i. Chapter 5: Rehabilitation Area Responsibilities and Characteristics
 - ii. Chapter 6: Incident Scene and Training Rehabilitation

- iii. **Initial** Medical Monitoring must include
 - a. Body Temperature
 - b. Heart Rate
 - c. Respiratory Rate
 - d. Blood Pressure
 - e. Pulse Oximetry
 - f. CO Monitoring if no SCBA was utilized *or* exhibiting flu-like symptoms
- b. Some propose instituting a “Decon Alley” in the warm zone between the hazard area and actual rehab **SLIDES 19-23**
(Avsec, R. 2018. *Decon alley-5 steps to doffing firefighter PPE*, Fire Rescue 1)
 - i. Gross wash (level 1 decon)
 - a. Low velocity water
 - b. Flush contaminants without driving them into fabric or harness
 - ii. Drop equipment (tools and radios)
 - iii. Doff PPE
 - a. Helmet and Hood
 - i. The hood acts like a gigantic sponge full of toxins around the firefighter’s neck and head
 - ii. Notice these are removed before gloves! This prevents further contamination of hands
 - b. Turnout Coat and Gloves
 - c. Turnout Pants
 - d. Boots
 - iv. Removal of SCBA facepiece (left on to reduce inhalation of off-gassing contamination)
 - v. Shut off cylinder and disarm PASS
 - vi. Personal hygiene (soap/water or wipes)
 - a. Head
 - b. Face
 - c. Neck
 - vii. Firefighter then proceeds to regular decon entry point

Note: this procedure may necessitate personnel have a change of clothing available at the Rehab site

Note: Firefighters performing the hose down and tool collection need to be at a level of PPE or beyond the structural firefighting ensemble to protect them from contaminated water and the inhalation of aerosolized contaminants as the PPE off-gases (potential concern when PPE is still hot after exiting the fire zone)

- c. Medical monitoring
- d. Firefighter enters either:
 - ▶ Rest and Recovery Area
 - ▶ Cooling and/or Warming Area
 - ▶ Rehydration/Caloric Intake/Electrolyte Replacement
- e. Final Medical Evaluation
- f. Released to:
 - ▶ Operations
 - ▶ Quarters
 - ▶ Transport to Hospital

2. Post-event

- a. Showering should become common practice.
 - i. Do not return to bed or lounge on furniture without removing as much of combustion byproducts as possible
 - ii. Canadian firefighters have been using saunas and bicycles to detoxify after a fire.
 - iii. The University of Alberta has identified that sweating is the best way to remove toxins from the body

F. APPARATUS MODIFICATIONS TO MINIMIZE CONTAMINANTS

SLIDES 24, 25

- 1. Internal Coatings and Coverings that are easily decontaminated and non-absorbant
- 2. HVAC with filtration
- 3. Electronic Monitoring for certain carcinogens and/or contaminants

4. PPE and SCBA storage outside the passenger compartment
5. Decontamination and hot water rinse outlets on engine
6. Dirty gear storage outside the passenger compartment
 - a. A Standard Operating Procedure developed in Sweden (The Skellefteå Model for Healthy Firefighters) has personnel strip out of used turnout gear and throw it into black garbage bags.
 - b. Garbage bags are then stored in the gear compartment of the fire truck
 - c. Several Canadian and U.S. jurisdictions have adopted various versions this model

G. FLORIDA FIREFIGHTERS ASSOCIATION MODEL

SLIDE 27

1. Gear donned at the scene, not at the station
 - Tests show little loss in response time**
2. No gear worn inside the passenger compartment of the apparatus
3. No PPE inside the inhabited areas of the station
4. Personnel handling dirty gear wear Nitrile/Latex gloves

H. ADDITIONAL PRECAUTIONS

1. Ensure that all gear is cleaned after a fire
 - a. Requires gear washer/extractor availability
 - b. May necessitate each firefighter be issued two sets of turnout gear
2. Do not transport or store contaminated clothing or gear in your personal vehicle
3. Keep gear out of living and sleeping areas
4. Get a professional cancer screening
5. Utilize a decontamination kit at the scene. Each kit includes a 5-gallon bucket, detergents, scrub brushes, hoses and spray bottles.
(<https://www.firerescue1.com/Personal-Protective-Equipment-PPE/articles/389876018-Fla-firefighters-get-decontamination-kits-to-fight-cancer-risk/>)
6. Keep abreast of new equipment such as particulate filtering hoods and turnout gear with better sealing properties. **SLIDE 28**
 - a. Smoke Resistant Turnout Project by DHS and North Carolina State University and Lion Apparel/Fire Dex

- b. Gore, Fire-Dex and PGI manufacturing hoods that block from 95 to 100% of particulates
- c. Utilize double layer of materials with Nomex Nano Flex or Stedair Prevent as an inner layer
- d. Elastic seals at wrist and waist of turnouts

I. Review

Firefighting increases the risk of certain cancers. Take steps personally and with your department to reduce your risk. Stay abreast of current research and equipment advances.

J. Remotivation

Firefighting is one of the most dangerous professions in this country and around the world. Don't let the "silent killer" take a back seat when it comes to your safety and well-being.

EVERYONE GOES HOME!