

# *“Saving Our Own From Cancer”*

*Taking Action Against  
Occupational Cancer  
In The Fire Service!*



*Presented by Harper College  
Department of Fire Science Technology*



# Learning Objectives

- Define what cancer is and how it affects our society.
- Recognize the scope of the cancer problem in the Fire Service over the past several decades.
- Examine the culture of the Fire Service regarding the use of PPE and SCBA.
- Discuss the increase in toxic agents in today's fire environment and how that affects Firefighters.
- Identify routes of exposure to cancer-causing agents.
- Discuss common Firefighter exposures to carcinogens.
- Review the steps Firefighters can take to protect themselves from cancer.
- Challenge Firefighters to change their culture.

# What is Cancer?

- **Cancer:** Is an abnormal growth of cells which tend to proliferate in an uncontrolled way and, in some cases, to metastasize (spread).
- Cancer is not one disease. It is a group of more than 100 different and distinctive diseases.
- Cancer can involve any tissue of the body and have many different forms in each body area. Most cancers are named for the type of cell or organ in which they start. If a cancer spreads (metastasizes), the new tumor bears the same name as the original (primary) tumor.
- Cancer may occur anywhere in the body. In women, breast cancer is one of the most common. In men, it's prostate cancer. Lung cancer and colorectal cancer affect both men and women in high numbers.

# The Affects of Cancer?

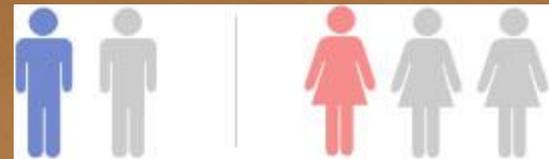
- According to the **Cancer Statistics - National Cancer Institute**, in 2016, an estimated 1,685,210 new cases of cancer will be diagnosed in the United States and 595,690 people will die from the disease.
- The most common cancers in 2016 are projected to be breast cancer, lung and bronchus cancer, prostate cancer, colon and rectum cancer, bladder cancer, melanoma of the skin, non-Hodgkin lymphoma, thyroid cancer, kidney and renal pelvis cancer, leukemia, endometrial cancer, and pancreatic cancer.



By the end of 2016

**1,000 PEOPLE  
EVERY DAY**

will be diagnosed with cancer



**1 in 2 men** and **1 in 3 women**  
will be diagnosed with cancer.

# Scope Of The Cancer Problem In The Fire Service

- Cancer is one of the most dangerous threats to the health and safety of firefighters everywhere.
- Multiple studies have proven the link between firefighting and cancer.



# Scope Of The Cancer Problem In The Fire Service

*“Pinpointing the exact cause of cancer is extremely difficult because firefighters are not exposed to just one agent. They are exposed to multiple cancer-causing agents. Because of the multiple exposures and the multiple routes of exposure – they inhale carcinogens and carcinogens are absorbed through the skin – it is also highly unlikely for firefighters to get only one type of cancer.”*

*- Dr. Grace Le Masters, PhD, Department of Environmental Health at the University of Cincinnati -*

# Scope Of The Cancer Problem In The Fire Service

Studies have shown higher rates of multiple types of cancers in firefighters compared to the general population including:

- Testicular cancer (2.02 times greater risk)
- Multiple myeloma (1.53 times greater risk)
- Non-Hodgkin's lymphoma (1.51 times greater risk)
- Skin cancer (1.39 times greater risk)
- Brain cancer (1.32 times greater risk)
- Malignant melanoma (1.31 times greater risk)
- Prostate cancer (1.28 times greater risk)
- Colon cancer (1.21 times greater risk)
- Leukemia (1.14 times greater risk)
- Breast cancer in women (preliminary study results from the San Francisco Fire Department)

# Scope Of The Cancer Problem In The Fire Service

*“Some cancer studies are also noting that firefighters are developing far more aggressive types of cancers, such as brain cancers, at a younger age than the general population, which provides further indications that the cancer could be a result of firefighting.”*

# Scope Of The Cancer Problem In The Fire Service



[Boston Fire Department Cancer Video](#)

# Scope Of The Cancer Problem In The Fire Service

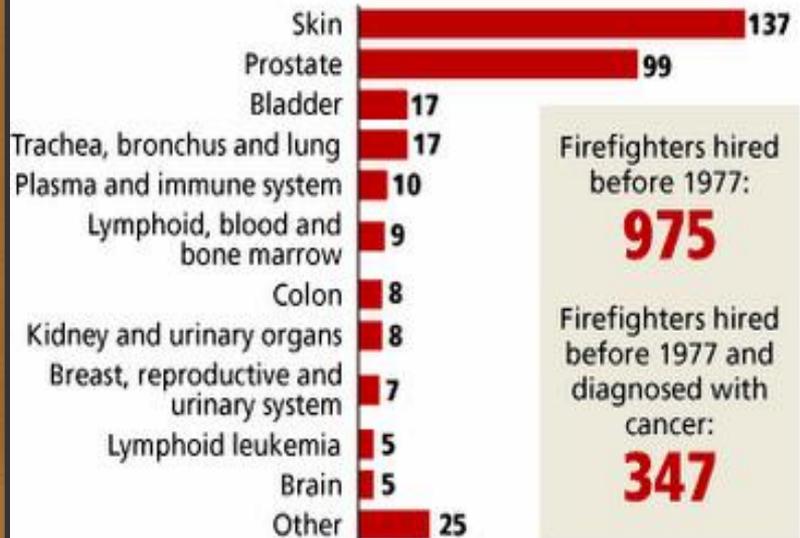
*36% of the 975 firefighters have been diagnosed with cancer!!!*

## FIGHTING FIRE, THEN CANCER

More than a third of Seattle firefighters hired before 1977 have developed cancer. Under Washington law seven forms of cancer are assumed to be job related when they are diagnosed in a firefighter, but Seattle firefighters say the city isn't doing enough to help screen them for health risks.

### Breakdown of firefighters hired before 1977 with cancer

By type of cancer, diagnosed between Jan. 2005 and June 2008

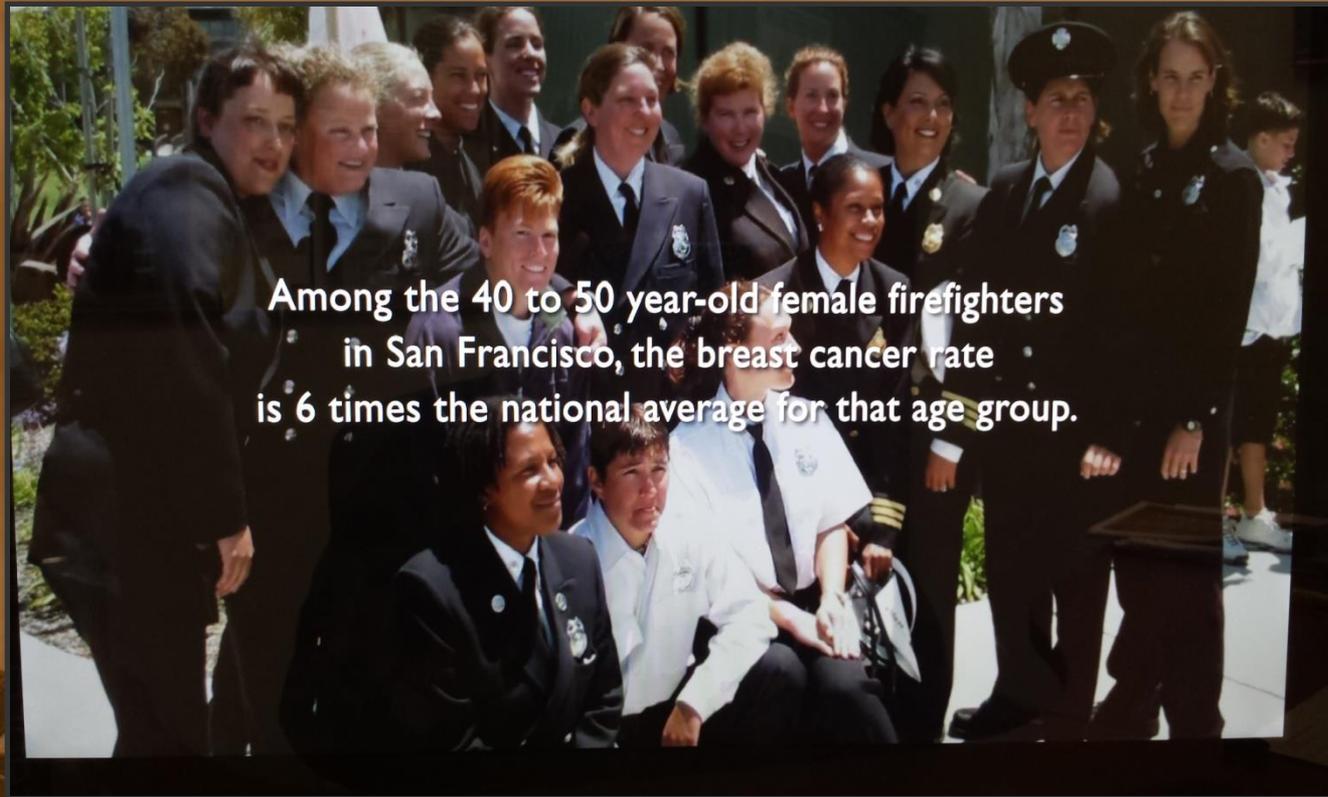


Source: Blue Cross and the Seattle Firefighters Pension Board SEATTLE P-1

# Scope Of The Cancer Problem In The Fire Service

- Miami-Dade Fire Rescue:
  - From 2008 to 2010, 32 percent of their firefighters (over 2000) were diagnosed with some form of cancer.
    - 1 in 3 firefighters in just 3 years.
    - Major cancer issues found:
      - Male: prostate, testicular, melanomas of the skin, brain/nervous system, head and neck (different than brain/nervous system), bladder, and colon.
      - Female: cervix, thyroid, breast, melanomas of the skin.

# Scope Of The Cancer Problem In The Fire Service (cont.)



Among the 40 to 50 year-old female firefighters  
in San Francisco, the breast cancer rate  
is 6 times the national average for that age group.

# Toxicity of Today's Homes



- Modern residential fires have more in common with hazmat incidents than with “legacy” house fires.
  - Contents made primarily of plastic and synthetic materials.
- Approximately 84,000 chemicals being used commercially today.
  - Flame retardants in furniture.
    - “Toxic Hot Seat”

- “Taking Action Against Cancer in the Fire Service” white paper – Firefighter Cancer Support Network; HBO Documentary film “Toxic Hot Seat” -

# Toxicity of Other Types of Fires

- Vehicle fires release highly concentrated toxic chemicals.
- Dumpster fires contain unknown materials and toxic substances.



- *"Taking Action Against Cancer in the Fire Service" white paper -*  
*Firefighter Cancer Support Network -*

# Toxicity of Other Types of Fires

Components of Vehicle Fire Smoke (present during start-up, knockdown, and overhaul):

- Acrolein - 3
- Methyl methacrylate - 3
- Acrylonitrile – 2B
- Ethyl benzene – 2B
- Toluene diisocyanate – 2B
- Hydrogen Chloride – 3
- Benzene – 1
- 1,3- Butadiene – 1
- Toluene - 3
- Styrene – 2B
- Formaldehyde – 1
- Naphthalene – 2B



# Routes of Exposure

- Two routes of greatest concern for exposure to carcinogens:
  - **The Lungs**: Occurs when firefighters do not wear or remove their SCBA too soon.
  - **Dermal Absorption**: Carcinogens are absorbed through the firefighter's skin.



YOU GUYS DO REALIZE THAT THE SMOKE IS JUST AS DANGEROUS AS THE FIRE, RIGHT?

# Routes of Exposure

- Skin can easily absorb chemicals – some areas are more permeable than others:
  - Face, angle of the jaw, neck, throat and groin.
  - Permeability increases with temperature.
    - Skin absorption increases by 400% for every 5° increase in skin temperature.

# Routes of Exposure

- *Most permeable piece of PPE is the hood.*



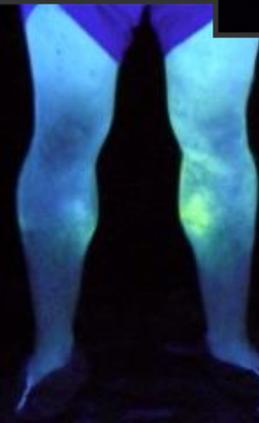
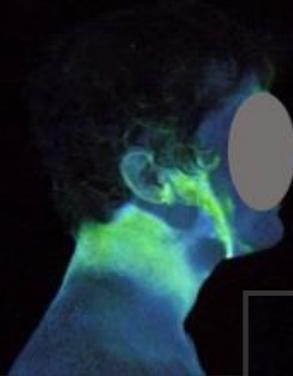
- Designed to protect the head and neck from heat.
- Not designed to stop skin absorption through the forehead, angle of the jaw, the neck, and throat.
  - Offers no vapor/moisture or smoke protection.
- Liquid integrity test.



- "Taking Action Against Cancer in the Fire Service" white paper – Firefighter Cancer Support Network; Jeffrey O. and Grace G. Stull – International Personal Protection Inc.; Evaluation of Dermal Exposure to Polycyclic Aromatic Hydrocarbons in Fire Fighters -

# Routes of Exposure

IAFF/RTI International Particle Infiltration Study - Video



# Routes of Exposure

- SAFD Cancer Prevention SOP – “Summary of Required Actions” Section .03 – A, D:
  - *All firefighters will be issued a 2<sup>nd</sup> hood. This will allow firefighting personnel to be able to wash and dry one hood after every use, thus allowing a clean hood for use at all times. The areas of the scalp and angle of the jaw are among the most absorbent areas of the body. Currently, our hoods are not manufactured with a moisture barrier. It is obvious then, that the hood must be kept as free of contaminants as possible.*
  - *Exposed areas of the body (neck and face) should be wiped off during re-hab.*



# Common Firefighter Exposures to Carcinogens

- During the overhaul process
- Soot particles
- Diesel engine exhaust



# Characterization of Firefighter Exposures During Fire Overhaul

- Today's synthetic and plastic household items present a risk to firefighters even after the fire is out.
  - Smoldering materials release chemicals that firefighters continue to breathe.



# Characterization of Firefighter Exposures During Fire Overhaul

## Chemicals found during the overhaul phase:

- **Formaldehyde - 1**
- **Asbestos - 1**
- **Benzene - 1**
- **Arsenic - 1**
- **Ethyl benzene – 2B**
- **Polynuclear aromatic hydrocarbons (PNAs) - 1\***
- **Polycyclic Aromatic Hydrocarbons (PAHs) - 1\***
- **Acetaldehyde – 2B**
- **Styrene – 2B**
- **Coal-Tar Pitch - 1**
- **Diesel exhaust - 1**
- **Vinyl Chloride – 1**
- **1,3-Butadiene – 1**

# Characterization of Firefighter Exposures During Fire Overhaul

*“Carbon monoxide should not be used as an indicator gas for other contaminants found in the overhaul atmosphere.”*

*- Characterization of Firefighter Exposures During Fire Overhaul Study – City of Phoenix -*



# Characterization of Firefighter Exposures During Fire Overhaul

- SAFD Cancer Prevention SOP – “Summary of Required Actions” Section 02 – L:
  - *Full bunker gear and SCBAs shall be worn through overhaul operations when products of combustion and/or gases and vapors are present.*



# Soot Particles

- First reported form of occupational cancer attributed to exposure to soot.
- Prolonged exposure to soot on the skin is a hazard.
  - Soot particles absorb hazardous vapors and hold them in place on surfaces including a firefighter's clothing and skin.



# Soot Particles

*“A major cause of cancer in firefighters is Polycyclic Aromatic Hydrocarbons absorbed through the skin as a result of contact with soot, persistently and under hot conditions. The especially high permeability of the groin area results in increased testicular cancer and possibly other types of cancer.”*

*- Dr. Stuart Baxter, PhD, Professor of Environmental Health at the University of Cincinnati -*



# Soot Particles

*“People think soot is benign but it is not, and most firefighters coming back from a fire are covered in soot. Soot isn’t just dirty, it’s dangerous”*

*“Soot in a firefighters’ hair or on their skin could leach chemicals into their bodies. Every smear on their clothes could release toxic gases long after the fire is out.”*

*- Dr. Grace Le Masters, PhD, Department of Environmental Health at the University of Cincinnati -*



# Soot Particles

- If not removed, contaminated exterior surfaces and inner layers of a firefighter's PPE can result in exposure well after the fire.
- Neck area is one of the most likely areas to become contaminated.
- Children being exposed to soot particles on our gear.
  - At home
  - Demos



# Soot Particles

- SAFD Cancer Prevention SOP – “Summary of Required Actions” Section .03 – B:
  - *Wet Decon – Immediate wet decon is essential to reducing contaminants that may have settled on your bunker gear (ex: asbestos). Therefore, wet decon is required anytime your gear may have been exposed to products of combustion or other contaminants, or if the Company Officer, Battalion Chief or Incident Commander deems it necessary. Every effort should be made to wet decon as soon as possible, preferably while still on scene. Use a red-line, at pump pressure, with a half opened nozzle. Rinse at a downward angle from top to bottom.*



# Soot Particles

- SAFD Cancer Prevention SOP – “Summary of Required Actions” Section .03 – C, D, K:
  - *Removing gear to return to the station is recommended. Additionally, at the end of each shift, if the gear was exposed to products of combustion or other contaminants, the gear will be rinsed off and hung to dry.*
  - *Shower as soon as possible after being exposed to products of combustion or other contaminants.*
  - *Apparatus seats should be cleaned and decontaminated regularly, especially after incidents where passengers were exposed to products of combustion.*



# Diesel Engine Exhaust

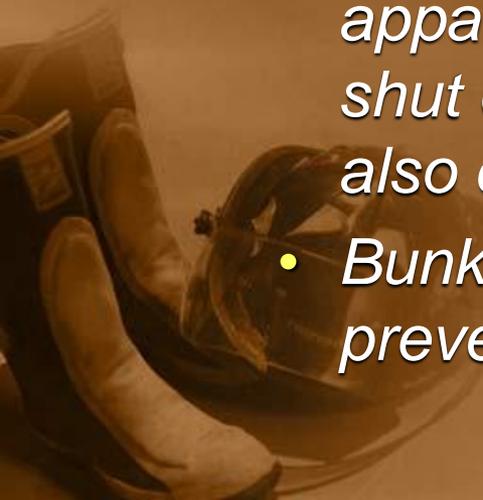
- On June 12, 2012, the International Agency for Research on Cancer (IARC) classified diesel engine exhaust as a Group 1 carcinogen.
  - Exposure is associated with an increased risk of lung cancer.
  - Can cause other types of cancer:
    - Bladder
    - Leukemia and other cancers of the blood (non-Hodgkin's lymphoma and multiple myeloma)
- Vented emissions can disperse up to 650 feet.

# Diesel Engine Exhaust

- Exposure to diesel engine exhaust at the fire station:
  - Walls and furniture reveal an incredible amount of diesel exhaust particles.
  - Diesel particles are inhaled and absorbed every shift which can cause significant harm to firefighters.
    - Regulators stored in bay.
    - Bunker gear stored in bay and taken into the station.

# Diesel Engine Exhaust

- SAFD Cancer Prevention SOP – “Summary of Required Actions” Section .03 - G, H, I:
  - *In order to reduce contamination by diesel exhaust, all apparatus and tools shall be started and idled outside the bay during routine checks and cleaning.*
  - *Bay doors shall be open before starting the apparatus and remain open until the apparatus is shut off; stations equipped with exhaust fans must also comply.*
  - *Bunker gear locker doors shall be closed to prevent contamination of gear by diesel exhaust.*



# Actions Firefighters Can Take to Protect Themselves From Cancer

- Often times, the steps that firefighters can take to protect themselves from exposure to carcinogens are simple and are easily accomplished.
  - “SAFD Cancer Prevention SOP”
- By understanding common exposures to cancer-causing agents, firefighters can take the necessary steps to keep themselves safe and healthy.





Mute



SAFD & Local 624 IAFF "Our Battle With Cancer" Video

# Summary *Firefighter Challenge*

- We are all responsible for our own safety.
- If you don't take care of yourself who do you expect to take care of you?
- Safety has to be our #1 Priority.
- More Firefighters are dying each and every year from Cancer, far more than any other category. LODD doesn't tell the whole story!
- We must change our culture and not accept Firefighters NOT using their PPE & SCBA.
- It takes all of us to make this happen.
- Start today and start "Saving Our Own!"



# Stay Safe!



# References

- Taking Action Against Cancer in the Fire Service white paper
- SAFD Cancer Prevention SOP
- The Toxic Hot Seat, HBO
- <http://monographs.iarc.fr/ENG/Classification/>
- <http://www.firerescue1.com/fire-products/Personal-protective-equipment-ppe/articles/1658839-8-ways-to-protect-against-cancer-with-PPE/>
- <http://www.modernfirefighter.com/cancer-the-unseen-firefighter-killer/>
- [http://www.breastcancer.org/symptoms/understand\\_bc/risk/understanding](http://www.breastcancer.org/symptoms/understand_bc/risk/understanding)
- Diesel Emissions in Fire Stations; Greg Michalak
- A Study on Chemicals Found in the Overhaul Phase of Structure Fires Using Advanced Portable Air Monitoring available for Chemical Speciation; Regional Hazardous Materials Team HM09-Tualatin Valley Fire & Rescue Office of State Fire Marshal
- Mortality and Cancer Incidence in a Pooled-Cohort of US Firefighters from San Francisco, Chicago, and Philadelphia (1950-2009); Daniels RD, Kubale TL, Yiin JH, et al. *Occup Environ Med* 2013;0:1–10. doi:10.1136/oemed-2013-101662.
- Exposure–response relationships for select cancer and non-cancer health outcomes in a cohort of US firefighters from San Francisco, Chicago and Philadelphia (1950–2009); Daniels RD, Bertke S, Dahm MM, et al. *Occup Environ Med* 2015;0:1–8. doi:10.1136/oemed-2014-102671.
- Fluorescent Aerosol Screening Test (FAST) Test Report – RTI International; Prepared by Jay Hill and prepared for Jeffrey O. Stull.

# References

- <http://monographs.iarc.fr/ENG/Monographs/vol98/mono98-7.pdf>
- [http://www.huffingtonpost.com/marcia-g-yerman/toxic-hot-seat-ignitesaw\\_b\\_4338572.html](http://www.huffingtonpost.com/marcia-g-yerman/toxic-hot-seat-ignitesaw_b_4338572.html)
- Evaluation of Chemical and Particle Exposures During Vehicle Fire Suppression Training; NIOSH
- Evaluation of Dermal Exposure to Polycyclic Aromatic Hydrocarbons in Firefighters; USDHHS, CDC, NIOSH
- Exposure of Firefighters to Diesel Emissions in Fire Stations; Southern Occupational Health Center and Division of Environmental and Occupational Health Sciences.
- Cancer Incidence Among Firefighters: 45 years of follow-up in five Nordic Countries; Pukkala E, Martinsen JI, Weiderpass E.
- Characterization of Firefighter Exposures During Fire Overhaul; Boldstad-Johnson, Dawn M., Burgess; Jefferey L., Crutchfield; Clifton D., Storment; Steve, Gerkin, Richard; Wilson, Jeffrey R.
- Cancer Risk Among Firefighters: A Review and Meta-analysis of 32 Studies; Grace K. LeMasters, PhD; Ash M. Genaidy, PhD; Paul Succop, PhD; James Deddens, PhD; Tarek Sobeih, MD, PhD; Heriberto Barrera-Viruet, PhD; Kari Dunning, PhD; James Lockey, MD, MS.
- <http://www.cancer.org/cancer/cancerbasics/lifetime-probability-of-developing-or-dying-from-cancer>
- [https://www.fsi.illinois.edu/newsDetail.cfm?news\\_id=172](https://www.fsi.illinois.edu/newsDetail.cfm?news_id=172)
- American Cancer Society
- <http://www.fireengineering.com/articles/2010/08/extinguishing-ff-cancer.html>

# References

- <https://www.osha.gov/SLTC/dieselexhaust/chemical.html>
- <http://www.911healthwatch.org/cancer/>
- <http://www.iafc.org/Operations/LegacyArticleDetail.cfm?ItemNumber=3356>
- <http://monographs.iarc.fr/ENG/Monographs/vol100F/mono100F-21.pdf>
- <https://eh.uc.edu/assets/news/11-27-2010-Lemasters.pdf>
- [https://en.wikipedia.org/wiki/Chimney\\_sweeps%27\\_carcinoma](https://en.wikipedia.org/wiki/Chimney_sweeps%27_carcinoma)
- Systemic Exposure to PAHs and Benzene in Firefighters Suppressing Controlled Structure Fires; Kenneth W. Fent, Judith Eisenberg, John Snawder, Deborah Sammons, Joachim D. Pleil, Matthew A. Stiegel, Charles Mueller, Gavin P. Horn, James Dalto.
- <http://www.iarc.fr/en/media-centre/pr/2007/pr180.html>
- <http://www.firerescue1.com/fire-products/hoods/articles/1677809-How-to-improve-the-next-gen-firefighter-hood/>
- Paul Combs, illustrations
- <http://www.firerescue1.com/fire-products/Personal-protective-equipment-ppe/articles/2154096-Firefighter-research-shows-PPE-exposure-risk/>
- [http://www.firefightercancersupport.org/wp-content/uploads/2013/06/fighting\\_fires\\_fighting\\_cancer.pdf](http://www.firefightercancersupport.org/wp-content/uploads/2013/06/fighting_fires_fighting_cancer.pdf)
- [http://www.iarc.fr/en/media-centre/pr/2012/pdfs/pr213\\_E.pdf](http://www.iarc.fr/en/media-centre/pr/2012/pdfs/pr213_E.pdf)
- <http://www.fasny.com/cancer-fire-service/>
- <http://www.sfexaminer.com/sanfrancisco/breast-cancer-rate-alarms-sffd-female-firefighters/Content?oid=2317524>