



National Institute of Environmental Health Sciences

Worker Training Program

“Protecting Workers from Hazardous Chemical Exposures through Training”

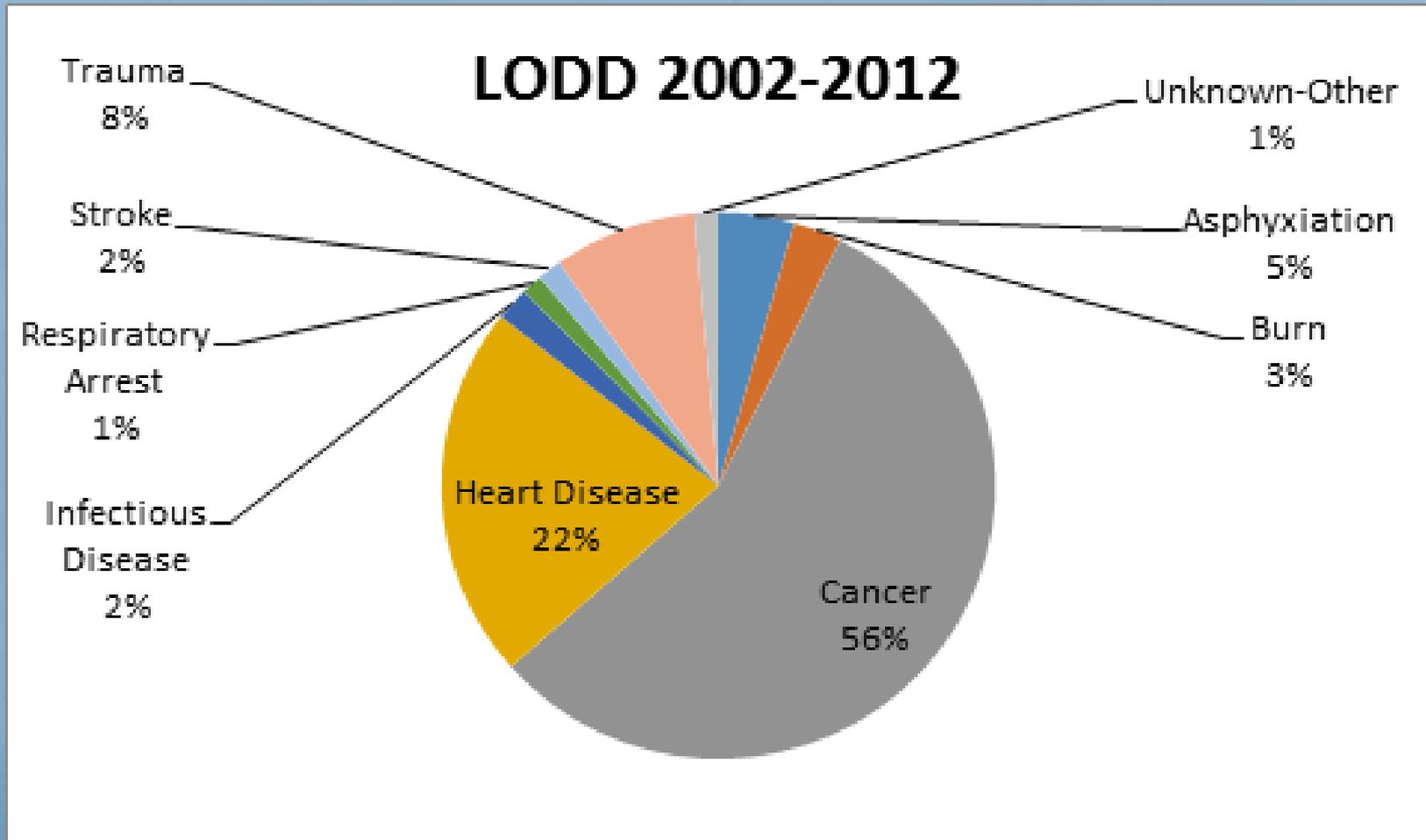
Pat Morrison

International Association of Fire Fighters

INTERNATIONAL ASSOCIATION OF FIRE FIGHTERS



Line of Duty Deaths 2002-2012



<http://www.iaff.org/>



Fires Today Are More Toxic



- Toxic, carcinogenic flame retardant chemicals in household products
- Foam furniture, carpets, mattresses, plastics, TVs, computers, electronics building insulation



Modern Day Fires are Different

"Today's residential fires have more in common with **hazmat events** than old-fashioned house fires due to the materials now common in homes such as plastics and synthetics."





Multiple Chemicals Are Released in Fires

- Chlorinated and brominated flame retardants (PBDEs*, chlorinated Tris, Firemaster)
- PCBs*, carbon tetrachloride*, vinyl chloride, pesticides
- Halogenated dioxins and furans (PBDD/Fs, PCDD/Fs)*
- Gases: hydrogen sulfide, hydrogen cyanide and hydrogen oxides
- Acids and aldehydes (formaldehyde*)
- Benzene, polycyclic aromatic hydrocarbons (PAHs*)
- Metals: cadmium*, lead, chromium*

* Carcinogens



Relevant Epidemiologic Studies

- Meta-analysis - research technique combining multiple studies
 - Pro - increased power to detect risk with more participants
 - Cons - quality, consistency of data
- LeMasters, JOEM, 2006
 - Combined data in 32 studies of fire fighters for 20 different cancer types
 - Risks for 10 types of cancer (50%) were significantly increased in fire fighters
 - Risks for the other 10 were increased but did not reach statistical significance



NIOSH Fire Fighter Cancer Study

- US National Institute for Occupational Safety and Health (NIOSH)
- One of the largest studies of US fire fighters
- Multi-year pooled historical cohort study started in 2010
- ~30,000 career fire fighters
 - Chicago, Philadelphia, and San Francisco Fire Departments, employed between 1950 and 2009
 - non-white and female fire fighters included
- <http://www.cdc.gov/niosh/firefighters/ffCancerStudy.html>



Phase I: Daniels, OEM, 2013

- Compares FF to general public, controlling for age, sex, race and calendar-time
- Results
 - 4461 cancer diagnoses (incidence), 3285 deaths
 - Increase in cancer rates overall (death and diagnosis)
 - Significant increases in certain cancers
 - Esophagus, large intestine, oral cavity, kidney, lung, mesothelioma
 - Incidence only – laryngeal and, in 17-64 year olds, bladder and prostate cancer
 - Mortality only – rectal, liver/gall bladder, and, in ≥ 65 year olds, non-Hodgkin's lymphoma and stomach



NIOSH Study Phase 2

- Detailed work histories of position(s) each fire fighter held and the length of time in the position
 - Cumulative number of fire runs, exposed days, fire run-hours
 - Use of personal protective equipment
 - Use of diesel exhaust controls
 - Very challenging
- Compare cancer risk in higher exposed FF compared to lower exposed



Nordic Study - Pukkala, OEM, 2014

- Cohort study of cancer incidence in 16,422 fire fighters from 5 Nordic countries
 - National cancer registries linked to census data on occupation from 1961-2005
- Increased risk for all cancers combined
- Statistically significant increases in specific cancers: melanoma and non-melanoma skin cancer, lung and prostate cancer
 - In specific ages: mesothelioma and multiple myeloma in 70+ year olds



Australian Study

- Cohort study of cancer mortality and incidence in fire fighters from 8 agencies
 - Full-time (n=17,394), part-time (n=12,663) and volunteer (n=163,159) from ~1980-2010 (depending on agency data)
- Overall cancer mortality significantly decreased
- Excess risk of cancer incidence in full- and part-time fire fighters for all cancers, prostate and melanoma
- Strong healthy worker effect
 - All cause death decreased (FT FF = 0.67, 0.6-0.7)
 - Relatively short follow-up
- Extensive additional data (275 page report)
 - Age; sex; exposure metrics = duration; # fires; employment date
- <http://www.coeh.monash.org/ausfireftr.html>



Elevated Risk of Cancers

- Testicular (2.02x greater risk)
- Multiple myeloma (2.53x greater risk)
- Non-Hodgkin's lymphoma (1.51x greater risk)
- Prostate cancer (1.28x greater risk)
- Colon Cancer (1.21x greater risk)
- Leukemia (1.14x greater risk)
- Breast Cancer in women (6x greater risk, SFFD)
- Skin Cancer (1.39x greater risk)
- Malignant Melanoma (1.31x greater risk)
- Brain Cancer (1.31x greater risk)



Routes of Exposure

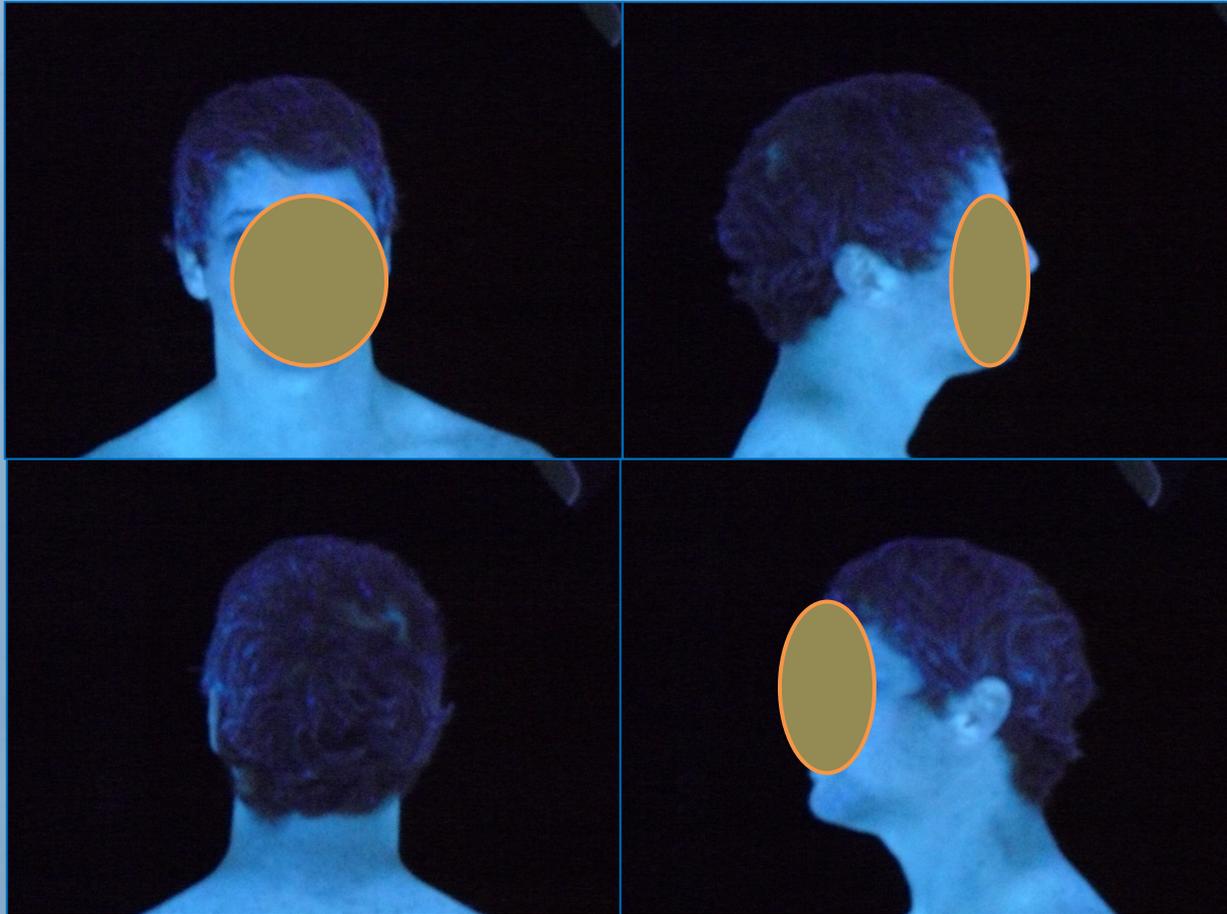
- Inhalation
- Ingestion
- Injection

- Absorption





Background UV Photos

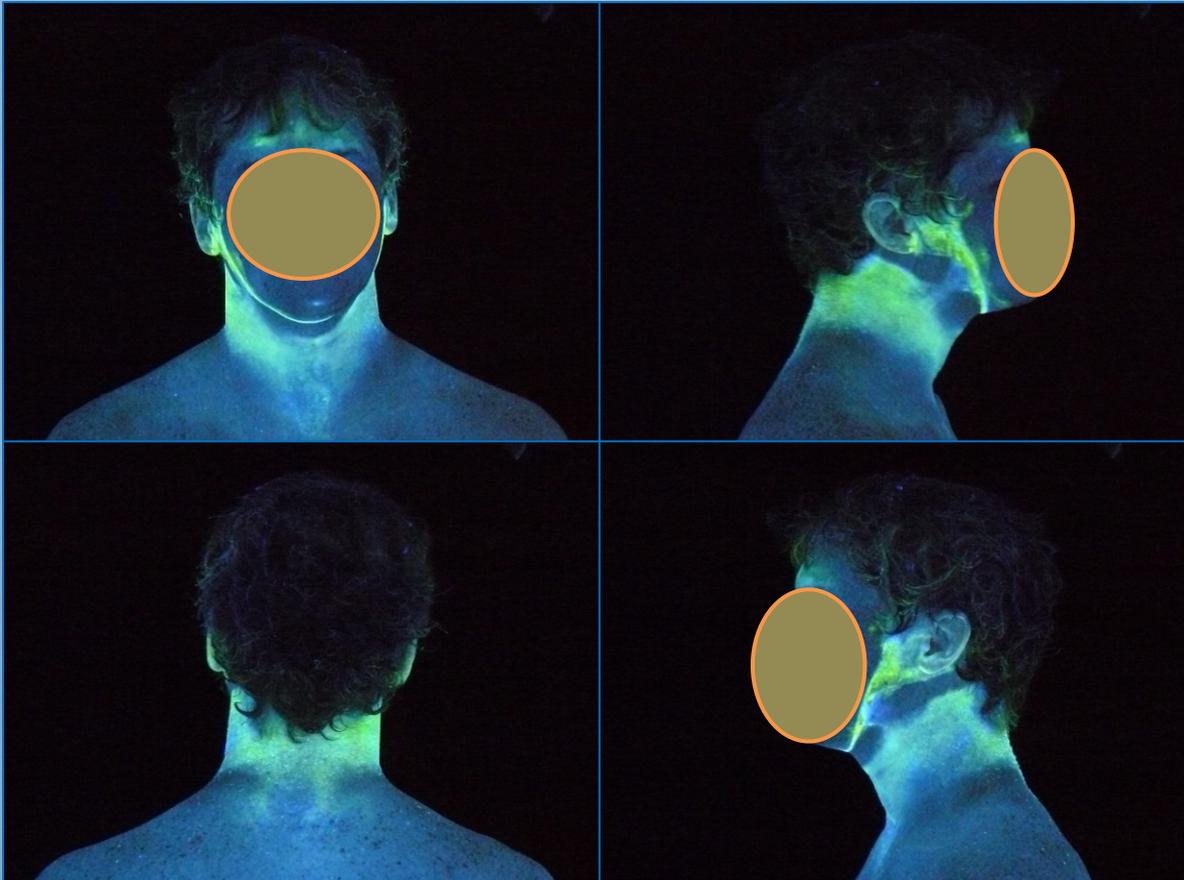


The background photos confirm the test participant was clean prior to donning the test garment.

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UV Photos: Head and Neck

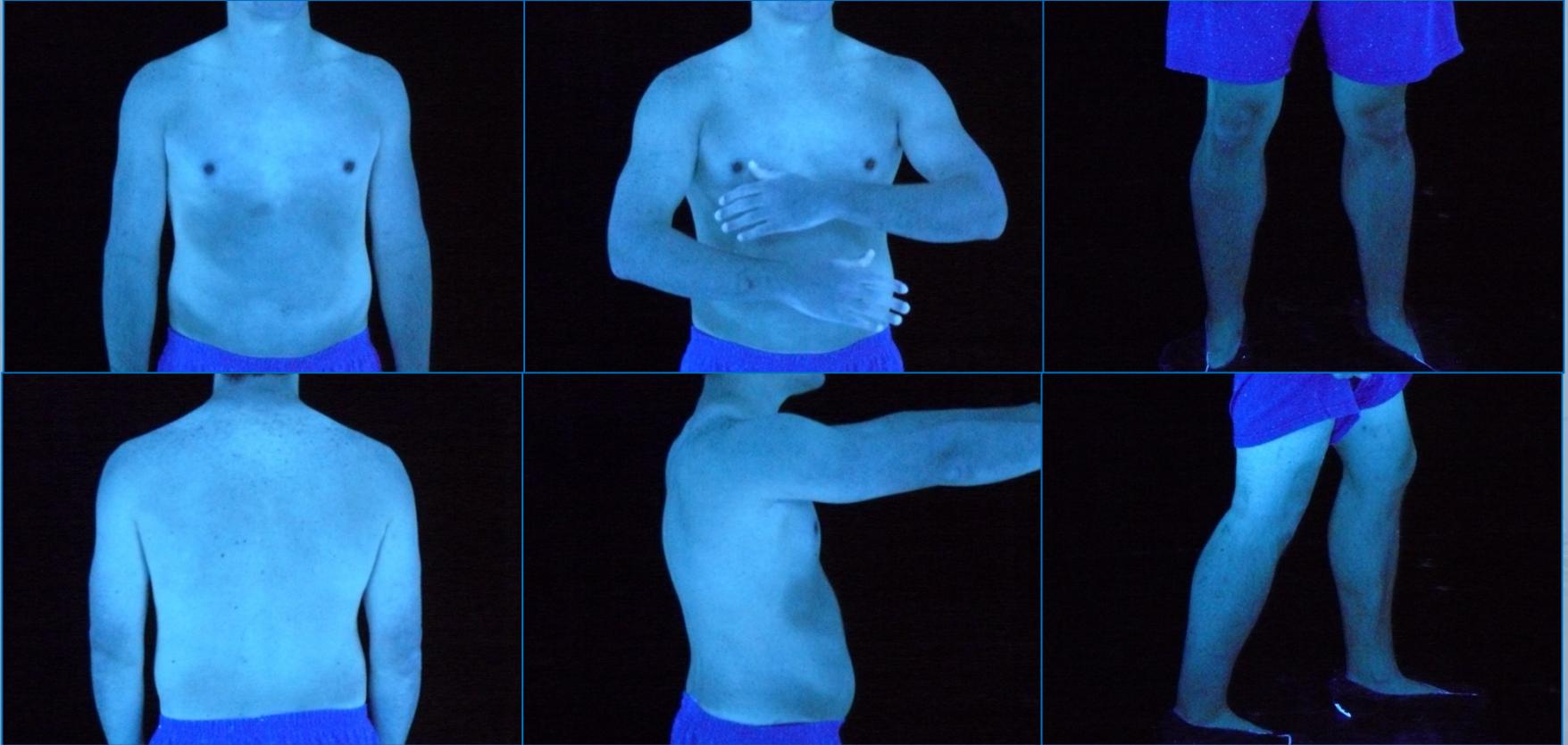


There were very heavy aerosol deposits on the neck, cheeks, ears, and hair due to penetration through the hood. The dark bands below the ears were relatively clean areas that were covered by the mask straps.

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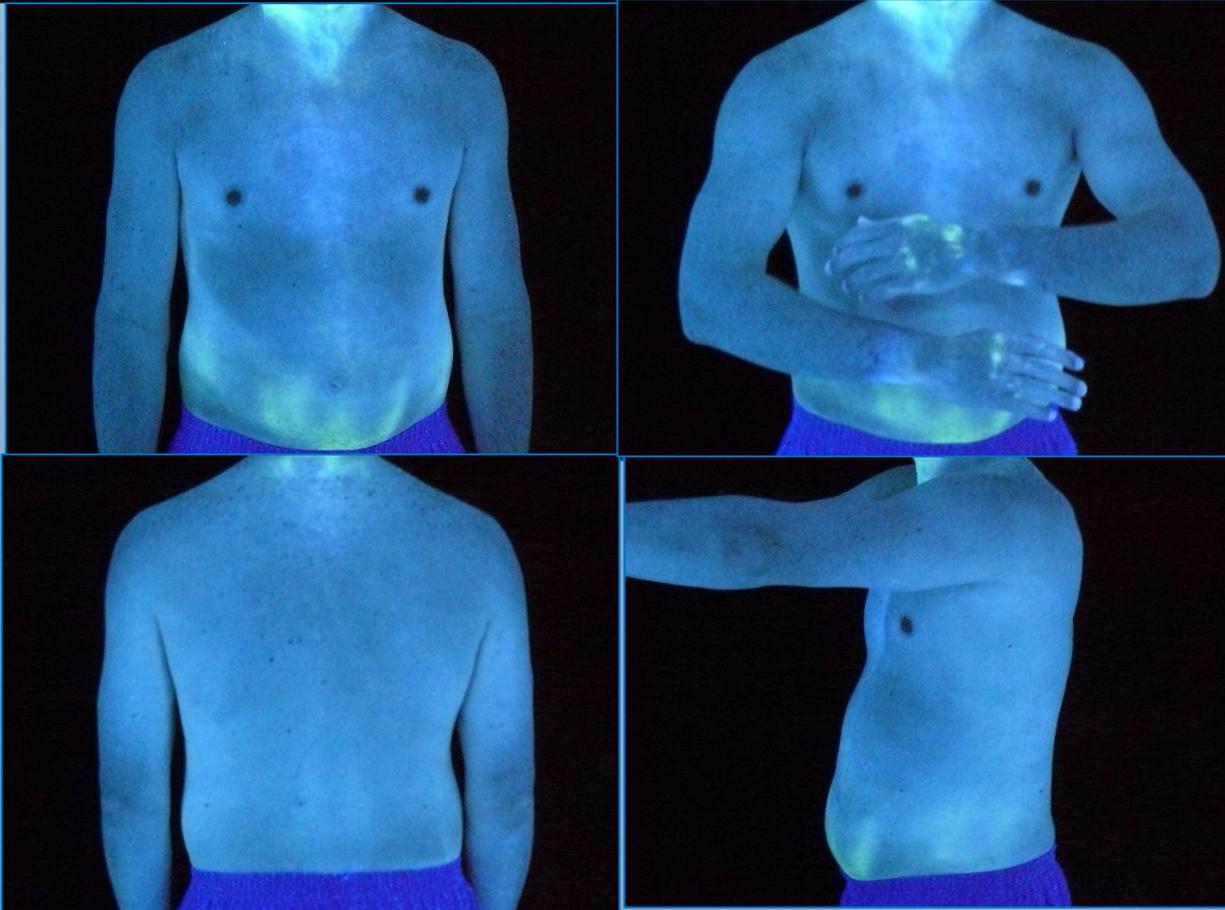
Background UV Photos



The background photos confirm the test participant was clean prior to donning the test garment. Variations in skin brightness seen in these photos are due to natural skin fluorescence.



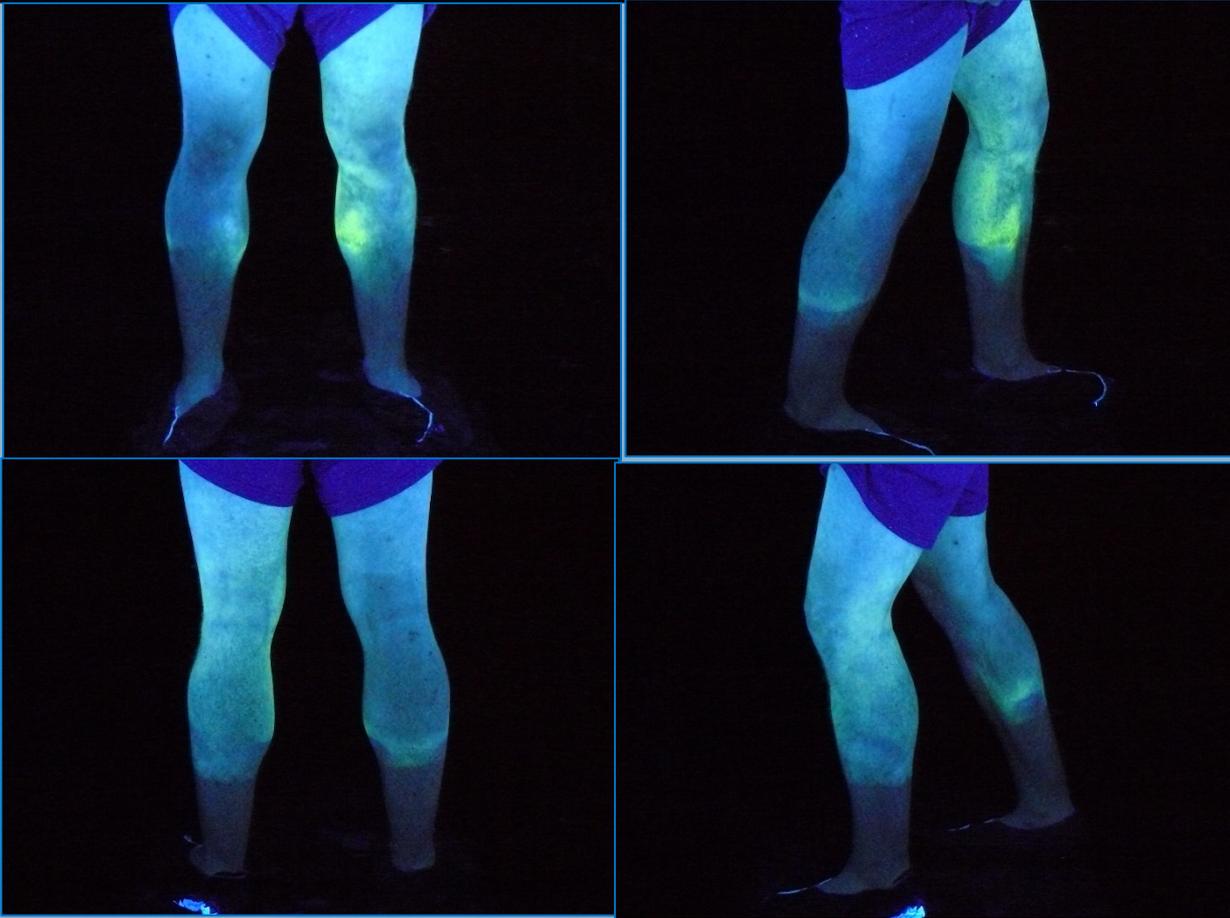
UV Photos: Torso and Arms



The lower front torso showed moderate to heavy aerosol deposits, and the location and pattern suggest infiltration through the coat-trouser interface. The bright spots on the hands and wrists could have been due to aerosol penetration, an artifact from doffing, or a combination of both.



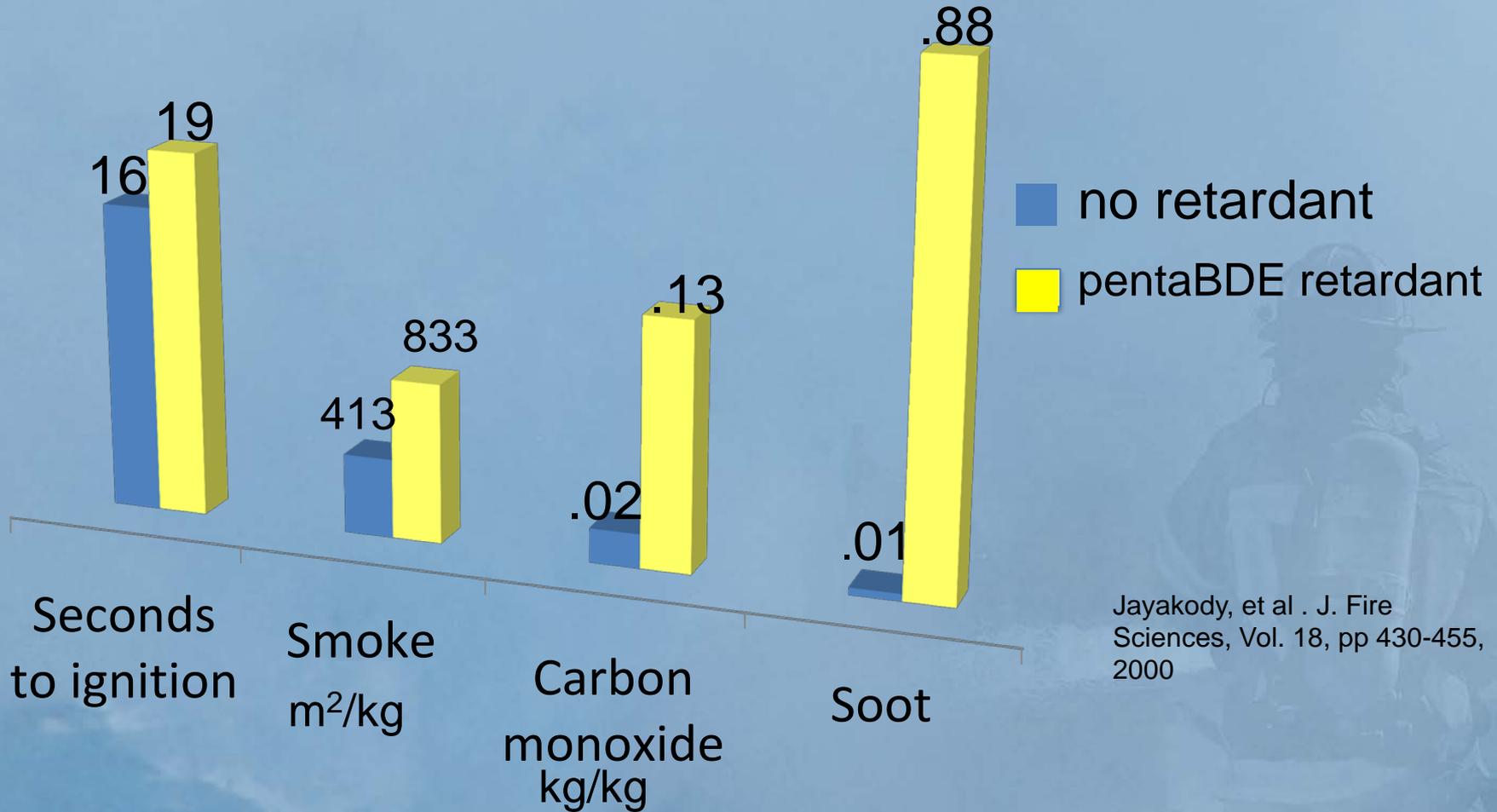
UV Photos: Legs



The lower legs had a high level of deposited aerosol. The patterns suggest aerosol infiltration through the boot-trouser interface and possible penetration through the trouser fabric.



Flame Retardants Increase Fire Toxicity



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Toxic Substances Control Act--TSCA

Summary of the Toxic Substances Control Act

15 U.S.C. §2601 et seq. (1976)

The Toxic Substances Control Act of 1976 provides EPA with authority to require reporting, record-keeping and testing requirements, and restrictions relating to chemical substances and/or mixtures. Certain substances are generally excluded from TSCA, including, among others, food, drugs, cosmetics and pesticides.

TSCA addresses the production, importation, use, and disposal of specific chemicals including [polychlorinated biphenyls \(PCBs\)](#), [asbestos](#), radon and [lead-based paint](#).

Quick Links

- [PDF of TSCA, from U.S. Senate](#) (106 pp, 263K, [About PDF](#))
- The official text of TSCA is available in [the United States Code on FDSys](#), from the U.S. Government Printing Office



IAFF Position

- Protect the ability of states and municipalities to enact laws regulating toxic chemicals, including flame retardants, and protect any such laws already enacted at the state, provincial or local level.
- Employ a strong health-based safety standard against which the Environmental Protection Agency (EPA) would judge dangerous chemicals, including flame retardants, and ensure that such a standard recognizes highly-exposed, vulnerable populations, such as fire fighters.
- Ensure a comprehensive, continuing review process to better evaluate the risk and health impacts of dangerous chemicals.

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NFPA Technical Committees



National Fire Protection Association

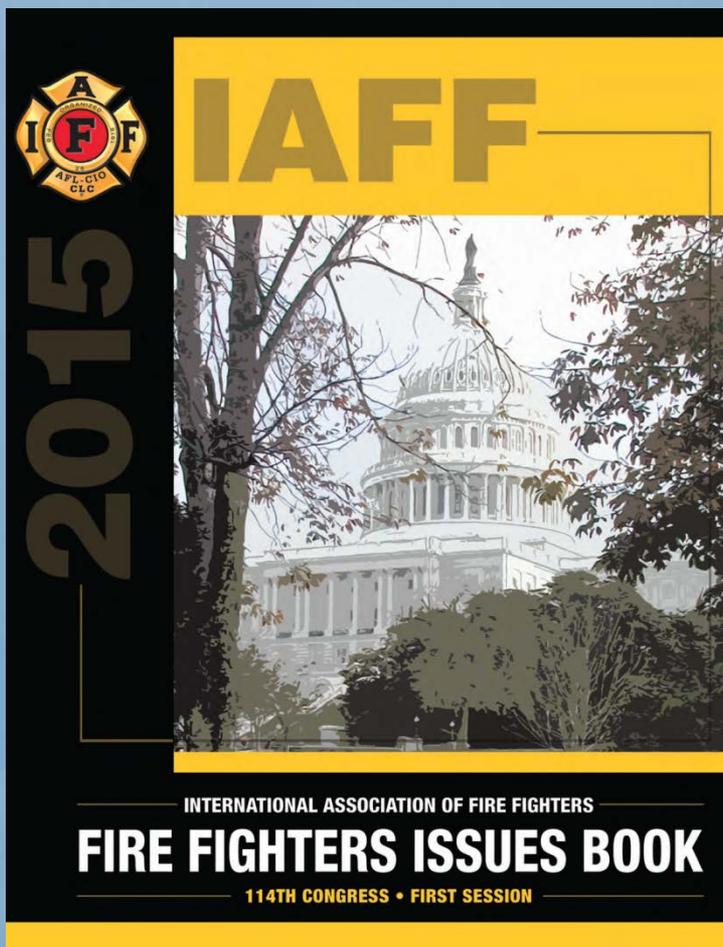
The authority on fire, electrical, and building safety

- IAFF representation on NFPA Technical Committees Crucial
- IAFF has two members on Tech Committee on Fire Tests
- Fire Test Committee determines open flame vs smoldering test
- Type of test will determine use of flame retardants

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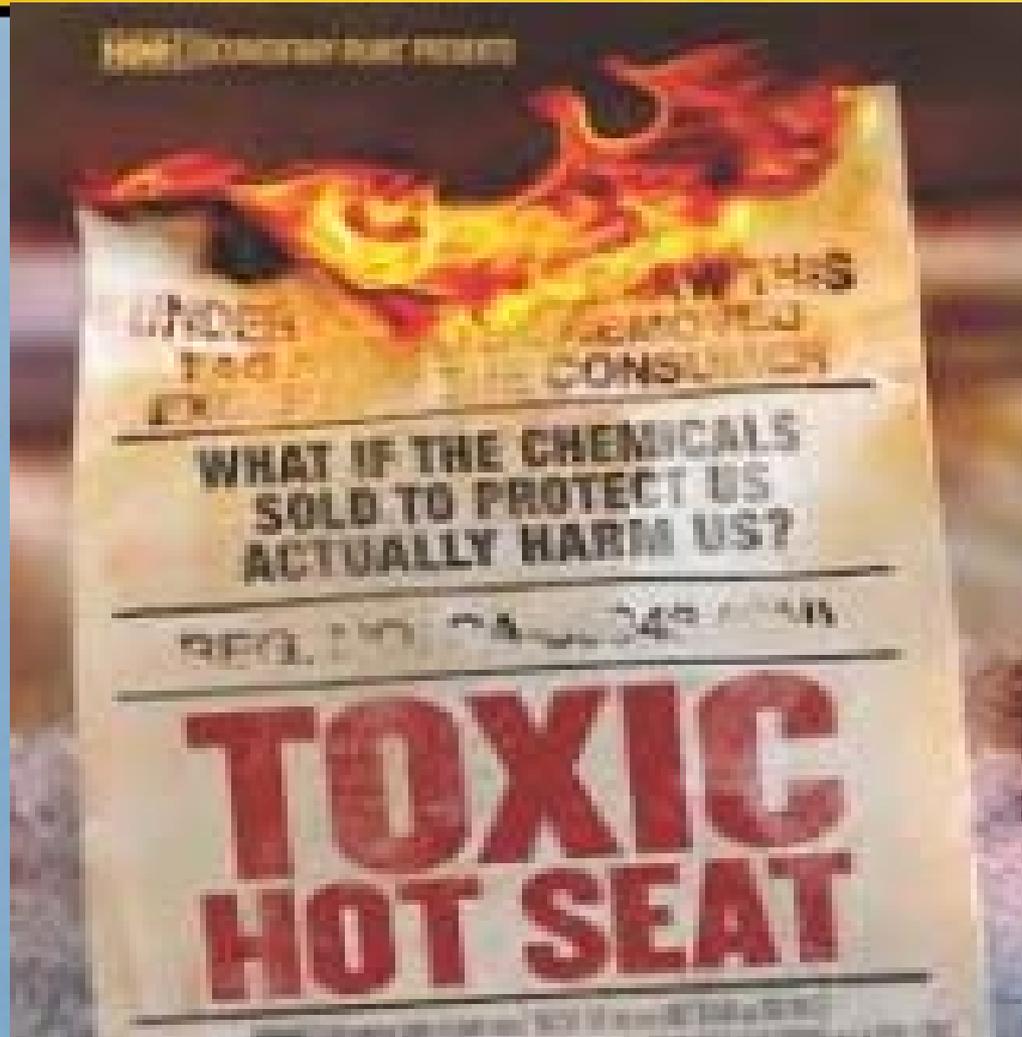
2015 IAFF Legislative Conference



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Chemical Industry Exposed



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