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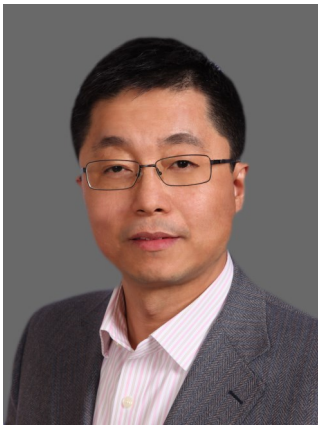

Topic of the Speech:

Fighting the Long-Term Health Impact: Cancer and Hazardous Substance Exposure in Firefighters and Understanding

Professor Guowen Song

College of Human Science
Iowa State University
United States

Professor Guowen Song is the Professor and the Noma Scott Lloyd Chair in the Department of Apparel, Event and Hospitality Management at Iowa State University's College of Human Sciences. He received his Ph.D. degree in Textile Engineering, Chemistry and Science, at North Carolina State University's College of Textiles in Raleigh, North Carolina.

Song's academic interest is functional textiles and protective clothing for human safety and health. His interdisciplinary research team applies a combined modeling and lab simulation approach to the study of protective system and its related technology. The research covers novel textile materials, system design, the simulation of hazards, PPE contamination, the analysis and prediction of clothing performance, as well as the development of new methods and standards. Dr. Song applies emerging technologies, including instrumented (flash fire, hot liquid, and sweating) manikins and 3D body scanning, smart wearables, 3D printing technology, and specialized human trials for material and product design. Recently he has been exploring a systematic and convergent approach to current PPE challenges, such as extremities, contamination and product fit and sizing. Recent efforts have also been placed on establishing AI and machine learning-powered models and simulations for developing intelligent interfaces and enhancing human-centered PPE design.

Dr. Song has published over 130 scientific papers in peer-reviewed journals and conference proceedings. He has authored four books and contributed a dozen chapters to books in his field of study.

ABSTRACT SUBMISSION
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Fighting the Long-Term Health Impact: Cancer and Hazardous Substance Exposure in Firefighters and Understanding

Guowen Song
Iowa State University, Ames, IA 50010, USA
Presenter's email: gwsong@iastate.edu

ABSTRACT (NO MORE THAN 500 WORDS:)

Toxic chemicals originating from fire ground combustion, contaminated Personal Protective Equipment (PPE), or off-gassing from PPE materials and chemical finishing have emerged as the foremost concern for the long-term health of firefighters. Exposure to fine smoke particles and toxic chemicals released during fire incidents poses significant health risks, including the potential for cancer, cardiovascular disease, and other pathological conditions. Minimizing this exposure has become a critical health priority for firefighters, who encounter risks not only at fire grounds but also in fire stations, vehicles, and even their homes due to resuspended fine particles or released volatile chemicals from contaminated PPE. The complexity of firefighter exposure to smoke, chemicals, and contaminated PPE, along with off-gassing from PPE materials, is highly specific. Contaminants interacting with PPE systems involve diverse physical, mechanical, and chemical mechanisms. absorption, penetration, bonding, and resuspension.

Fireground smoke comprises a multitude of toxic substrates, manifesting as suspended liquids, particles, gases, and vapors resulting from the combustion or pyrolysis of materials. The prevalent use of synthetic polymers in modern buildings and furniture has heightened the production of particles and toxic chemicals, including carcinogens such as Semi-Volatile Organic Compounds (SVOCs) like Polycyclic Aromatic Hydrocarbons (PAHs), Volatile Organic Compounds (VOCs). Fine particles containing PAHs can be retained or trapped in the PPE system, easily entering the interface between PPE components during firefighting and spreading to the human body or surrounding environment during doffing. Cross-contamination on PPE components is also identified in maintenance processes, such as laundering. Consequently, in addition to fire ground exposure, the risk of inhalation and dermal absorption of carcinogens and other toxicants is elevated when exposed to contaminated and improperly-cleaned PPE.

Common VOCs present in fire scenes include Benzene, Ethylbenzene, Toluene, and Xylene (BETXs), along with formaldehyde. Heavy metals, as special contaminants arising from combustion products in items containing heavy metals (e.g., electroplate materials), can be detected at fire scenes and on firefighter PPE, resulting in adverse health outcomes. Firefighters can experience dermal absorption of heavy metals through direct contact with contaminated turnout gear, while airborne particulate-bound metals can be inhaled. An additional concern arises regarding the impact of Per- and Polyfluoroalkyl substances (PFAS) from aqueous film-forming foams and manufactured PPE with fluorinated treatment on firefighter exposure. PFAS, stable in the environment and soluble in water, shed from contaminated PPE into the surrounding environment, including fire stations.

The overarching goal of the current research is to advance understanding of carcinogens as a hazard source, their interaction with PPE systems and firefighters, and to propose approaches for decontamination and prevention. This encompasses investigating the intricate mechanisms of contamination, decontamination effectiveness, the impact on firefighter safety and health, exploring new technologies for understanding and prevention, and studying applications and control measures.