2024 Urban Fire Forum (UFF) Position Statement

Statement in Support of Further Research on Non-PFAS Based PPE and In-Service Training Considerations

Introduction:

In 2022, the classification of firefighting as a Group 1 known human carcinogen by the International Agency for Research on Cancer (IARC) underscores the critical need to address the multiple hazards faced by firefighters [Demers et al. (2022)]. While significant progress has been made in understanding the dangers posed by external contaminants like combustion byproducts, attention is now turning to internal hazards, particularly the presence of per- and poly-fluoroalkyl substances (PFAS) in firefighting gear [Ormond (2024)]. PFAS chemicals, known for their persistence in both the environment and the human body, have been shown to increase cancer risk, necessitating the exploration of safer alternatives in personal protective equipment (PPE) [Zahm et al. (2023)].

The complexities surrounding PFAS exposure and the evolving science of non-PFAS PPE alternatives demand continued and expanded research. Studies have already revealed that PFAS contamination varies across layers of turnout gear [Peaslee et al. (2020), Muensterman et al. (2022), Maizel et al. (2023)]. With non-PFAS alternatives, research must also extend to training and operational protocols, ensuring that firefighters are properly equipped to manage any enhancements or limitations presented by new PPE technologies.

Therefore, the Urban Fire Forum supports continued investment in research on non-PFAS PPE, combined with comprehensive firefighter training, as vital for reducing occupational cancer risks while maintaining the highest standards of safety and operational effectiveness. Through this deliberate approach to In-Service Training and Deployment coupled with ongoing exploration, we can safeguard the health of our firefighters while advancing the science of protective technologies.

When deploying new non-PFAS-based PPE, several key factors should be considered to safely assess the gear's capabilities and their impacts on firefighter performance in high-risk environments. First, an evaluation of the thermal and moisture protection provided by the new PPE is crucial, as it may behave differently than previous ensembles, potentially affecting heat stress, fit, functionality, and comfort. Currently, there is very little research that is available in the published peer-reviewed literature that studies the potential performance trade-offs of non-PFAS-based turnout gear. Through a FEMA Assistance to Firefighter Grant Research program, North Carolina State University (NCSU) is currently conducting ongoing research addressing this aspect. Additionally, understanding how the new materials perform in various environmental conditions, including extreme heat, breathability, and exposure to hazardous substances, will help determine appropriate work-rest cycles, rotations, and rehabilitation protocols. Firefighters should also be trained to recognize the qualities of the gear, particularly in terms of durability and the potential necessity for more frequent cleaning and decontamination procedures to avoid exposure to harmful carcinogens and to ensure maximum protective performance. Continuous feedback from users and ongoing monitoring of PPE performance in the field and the training environment will help refine protocols, ensuring both the safety and operational efficiency of firefighters while using this new generation of protective gear.

Recommended Considerations:

1. **Pre-Deployment Testing**
    - **Performance testing**: Conduct testing under conditions that simulate the high-risk environment. Specifically, measure the performance of the new PPE as compared to older generations of PPE.
    - **Durability and wear**: Closely inspect PPE under the new standard for signs of wear and tear during testing to evaluate its durability in a high-risk environment.
    - **Pilot program**: Consider a pilot deployment of the new PPE in a controlled setting to gather real-world metrics and analytics data on its performance and any operational differences.
2. **PPE Suitability**
    - **Assess protective gaps**: Identify the specific protective qualities that are changing in the new PPE compared to the previous ensemble (e.g., thermal protection, chemical resistance, heat stress, etc.).
    - **Risk compensation strategies**: Develop strategies to compensate for identified gaps, such as modifying work practices, limiting exposure time, or providing additional layers of protection (e.g., use of "heat channels" in areas of compression; shoulders, elbows, and knees).
3. **Risk Assessment**
    - **Re-evaluate hazards**: Reassess the high-risk environment with the new PPE in mind. Consider whether the protective qualities expose the wearer to additional risks, and how these can be mitigated.
    - **Rules of Engagement**: Define any specific scenarios or environments where the use of the new PPE should be limited due to the protective qualities of the ensembles.
    - **Adjusted work limits**: Introduce tighter safety protocols around exposure time, workloads, and environmental conditions to account for the qualities of the new PPE.

4. **Training and Competence**
    - **Enhanced training:** Provide enhanced in-service training to ensure Firefighters fully understand any limitations of the new PPE and how to work within those limitations.
    - **Behavioral adaptation:** Train personnel on compensatory behaviors (e.g., increased distance from heat sources, limiting exposure to hazardous materials) to mitigate risk.
5. **Modified Firefighter Rehabilitation**
    - **Revised rehab protocols**: Modify firefighter rehabilitation protocols during incidents to account for PPE thermal management. Consider shorter work cycles and longer rest periods, allowing firefighters more time to recover.
    - **Cooling techniques**: Ensure access to cooling methods (e.g., cold water immersion, misting fans, or ice packs) during rehabilitation, particularly if the new gear PPE does not offer the same level of heat release.
    - **Nutritional support**: Provide high-quality hydration and nutritional support during rehab to ensure that firefighters can replenish fluids, electrolytes, and energy lost during exposure to high heat or physical exertion.
6. **Post-Exposure Gear Cleaning and Decontamination**
    - **Decontamination of PPE:** Develop strict post-exposure cleaning and decontamination protocols for the PPE, ensuring that carcinogenic particles, chemical residues, and toxic substances are removed after every incident.
    - **On-site gross decontamination:** Set up on-scene decontamination stations where firefighters can immediately clean their gear after exposure to hazardous substances, especially if the new PPE offers reduced chemical or particulate protection.
    - **Routine deep cleaning:** Schedule regular advanced cleanings of the gear using specialized equipment (e.g., detergent soaking, water extractors, liquid carbon dioxide cleaning, etc.) to reduce long-term exposure to harmful substances trapped in the fabric, given that clean fabrics are more physically protective for firefighting environments.
7. **Post-Deployment Review**
    - **Early-stage audit**: Perform an early-stage audit (e.g., 30, 60, or 90 days after deployment) to evaluate the effectiveness of the new PPE and identify any unexpected issues.
    - **User feedback analysis**: Analyze feedback from firefighters to identify discomforts, issues, or improvements that may be needed.
    - **Performance adjustments**: Based on audit findings, consider adjustments to work protocols or PPE design.
    - **Durability and Life Cycle Assessment**: Gather wearer feedback and conduct periodic garment testing to evaluate the PPE's durability and performance under real-world conditions. Assess its resistance to wear, heat, and repeated decontamination. This feedback, combined with testing, can help determine the appropriate life cycle of the PPE, ensuring long-term firefighter safety.

References:

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3. Zahm S et al., **Carcinogenicity of perfluorooctanoic acid (PFOA) and perfluorooctanesulfonic acid (PFOS),** The Lancet Oncology, 2023, Volume 25, Issue 1, 16 - 17.

4. Peaslee, G F et al., **Another pathway for firefighter exposure to per-and polyfluoroalkyl substances: Firefighter textiles**, 2020. Environ. Sci. Technol. Lett. 7 (8), 594–599.

5. Muensterman, D J et al. **Disposition of fluorine on new firefighter turnout gear**, 2022 Environmental science & technology. 56 (2), 974-983.

6. Maizel, A C et al., **Per- and Polyfluoroalkyl Substances in New Firefighter Turnout Gear Textiles,** 2023. National Institute of Standards and Technology, Gaithersburg, MD, NIST Technical Note (TN) NIST TN 2248.