Re: Second Draft of NFPA 1970, *Standard on Protective Ensembles for Structural and Proximity Firefighting, Work Apparel and Open-Circuit Self-Contained Breathing Apparatus (SCBA) for Emergency Services, and Personal Alert Safety Systems (PASS)*

To Whom It May Concern,

Thank you for providing the opportunity to comment on the proposed NFPA 1970 Standards. As UC Berkeley Environmental Health Graduate students, we are educated about occupational health issues and passionate about addressing them. Along with colleagues in UC Berkeley's Chemistry and Civil and Environmental Engineering Departments, we spent the past five months researching safer, PFAS-free alternatives to the moisture barrier layer in firefighter turnout gear.

We are writing today to provide supporting evidence for the removal of the light degradation test for the moisture barrier. The update to remove this particular test is currently included in the first draft of NFPA 1970. We advocate for its absence.

Why Remove the Light Degradation Resistance Test?

- Polytetrafluoroethylene (PTFE) is the only material that currently meets the light degradation test (UV light test).
- PTFE is a commonly used per- and polyfluoroalkyl substance (PFAS). PFAS are a group of chemicals which are carcinogenic, are linked to many health effects such as damage to the liver and immune system, and bioaccumulate in the human body. The PTFE moisture barrier is exposing firefighters to these hazards, on top of their various other occupational hazards.
- Since the moisture barrier sits inside the middle of the three-layered turnout gear set, it is not exposed to UV light, making the test unnecessary and prohibitive to PFAS-free alternatives.
- The European and Australian firefighter turnout gear standards do not require a UV light test.
- Removing the UV light test would open up opportunities for finding safer alternative materials for the moisture barrier, without further compromising firefighter health, while still meeting the required function.

The composition of firefighter turnout gear has come under scrutiny due to the adverse health effects of per- and polyfluoroalkyl Substances (PFAS) found in the gear. A class of over 9,000 unique chemicals, well-studied PFAS have been linked to certain cancers, thyroid disease, reproductive problems, and other serious adverse health effects (Goodrich et al). Firefighters are already exposed to many carcinogenic air pollutants from smoke, and firefighting materials, such

as aqueous film forming foams (AFFF) – their uniforms should not be an additional occupational health concern.

Firefighting as an occupational exposure is classified as a Group 1 carcinogen (Demers et al., 2022). The National Institute for Occupational Safety and Health (NIOSH) reports that firefighters have a 9% higher risk of cancer diagnosis and a 14% higher risk of cancer-caused mortality than the total U.S. population (Daniels et. al., 2013). It is also essential to consider the healthy worker effect in this context. The healthy worker effect suggests that workers are typically healthier than the general population due to their ability to work, further emphasizing the significance of these statistics.

Existing firefighter turnout gear is typically made up of three layers: an inner thermal layer closest to the skin, a middle moisture barrier, and a durable water-repellent (DWR) outer shell. The primary function of the moisture barrier is to block penetration by water, water vapor, liquid chemicals, and heat while allowing perspiration and body heat to escape (Peaslee et al., 2020). Liquid resistance and vapor permeability is particularly important for the prevention of steam burns which occur if water and heat get trapped inside the gear (Su et al., 2018; "Why Firefighters Get Steam Burns," 2015).

The NFPA sets standards on Protective Ensembles for Structural Fire Fighting and Proximity Fire Fighting in the United States and Canada. The current moisture barrier layer, approved by the NFPA 1971 Standards, contains a polytetrafluorethylene (PTFE) laminate layer. PTFE, a synthetic fluoropolymer, is one of the most well-known and applied PFAS. It is effective in turnout gear due to its water and oil resistance, thermal stability, and breathability (Graham et al, 2020). PTFE itself is considered inert; however, other PFAS chemicals used in the manufacturing process are present on the gear and pose health risks to the wearer as well as persist in the environment. Studies found that PFAS migrates across turnout gear layers into untreated material such as the inner thermal layer. Elevated blood levels of PFAS have been measured in firefighters, and dermal absorption from direct skin contact with turnout gear is one key exposure route (Peaslee et al., 2020, Trowbridge et al., 2020, Laitinen et al., 2014).

As specified in Section 8.62 of the NFPA 1971 Standards, the Light Degradation Resistance Test, also known as the UV light test, "shall apply to moisture barrier materials" and be tested individually, apart from the thermal inner layer and outer shell (National Fire Protection Association). Since the moisture barrier sits inside the other two turnout gear layers, it does not come into contact with UV light, making the UV light test unnecessary and illogical to require. A PTFE laminate is the only material that can meet this test, so removing the UV light test would allow for PFAS-free moisture barrier options.

In our research on PFAS-free alternatives for the moisture barrier, we conducted a policy review, comparing the NFPA 1971 Standards to the European Union (EN 469) and Australian (AUS) Standards for firefighter turnout gear. We found that the UV light test was included in the NFPA Standards but excluded from the EN 469 and AUS Standards, suggesting that the test is considered unnecessary in other countries.

Each turnout gear ensemble has a lifespan of ten years or fewer depending on condition, as required by NFPA 1971 (National Fire Protection Association). Aptly named "forever chemicals," PFAS are extremely bioaccumulative and persistent in the environment, so promptly finding safer alternatives to gear that could be worn for up to a decade is important for preventing adverse health outcomes for firefighters and future degradation to the environment.

In conclusion, the NFPA 1971 Light Degradation Resistance Test is unnecessary for the moisture barrier to meet and prohibits PFAS-free options from coming to market. This is an occupational health issue and supporting the removal of this test can lead to safer working conditions for firefighters.

Sincerely,

Sophia Glazer, BS, MPH Candidate

McKenna Thompson, BS, MPH Candidate

Sophie Thompson, BA, MPH Candidate

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