PFAS and Firefighters: A short overview

PFAS-REACH
PFAS Research, Education, and Action for Community Health

Studies show that firefighters have higher rates of cancer compared to the general population (1). To protect their health, it's important to understand how on-the-job exposures to toxic chemicals may increase their cancer risk. Firefighters are exposed to a variety of cancer-causing chemicals released from burning materials during a fire. Firefighting equipment and gear also contain harmful chemicals, including a class of chemicals called PFAS (per- and polyfluoroalkyl substances). Occupational exposures to PFAS are of particular concern because some PFAS have been linked to harmful health effects. These include cancers (such as testicular and kidney), high cholesterol, preeclampsia, liver damage, thyroid disease, decreased response to vaccines, infertility, and developmental problems, including low birth weight. What's more, PFAS don't break down and some can remain in the body for years. Unfortunately, firefighters have been exposed to toxic PFAS without their knowledge for decades.

What do studies of PFAS in the blood of firefighters tell us?

Multiple studies have found that firefighters have elevated levels of PFAS in their blood (2-8). In particular, firefighters who repeatedly use Class B aqueous film-forming foam (AFFF) in fire emergencies and training exercises have higher levels of PFAS in their blood compared to the general population (6, 8-10). Other notable findings include:

- The Women Firefighters Biomonitoring Collaborative Study in San Francisco found higher levels of three long-chain PFAS (PFNA, PFHxS, and PFUnDA) in the blood of female firefighters compared to female office workers (10)

- 9/11 first responders had higher blood levels of three long-chain PFAS (PFOA, PFNA, and PFHxS) than the general population. These differences are likely due to dust and smoke inhalation as well as firefighting foams (11).
- Volunteer firefighters in New Jersey were found to have higher blood levels of three long-chain PFAS (PFNA, PFDA, and PFDoDA) compared to the general population. Firefighters with more years of service had higher levels of PFDA and PFDoDA (12).

How are firefighters exposed?

Certain firefighting foams, turnout gear, and fire station dust are common sources of PFAS exposure to firefighters.

Firefighting foam

Some manufacturers add PFAS to AFFF, which is used to fight fuel fires. Older formulations of AFFF contained long-chain PFAS, such as PFOS and PFOA. These PFAS are no longer manufactured in the U.S. due to their toxicity. Newer formulations of AFFF contain newer types of PFAS, including short-chain

PFAS, which are also persistent.3 Firefighters can be exposed to PFAS from droplets of AFFF in the air during firefighting activities, from direct skin contact with AFFF, and from drinking AFFF-contaminated water, particularly when these foams are used close to drinking water wells serving fire stations (9, 13).

Turnout Gear

Turnout gear is multilayered clothing designed to protect firefighters. Manufacturers add fluoropolymers—a PFAS used in Teflon-based products—to layers of turnout gear to make it water-resistant and compliant with industry standards. One of these standards, the National Firefighter Protection Association's Standard 1971, requires that the moisture barrier of turnout gear be able to withstand UV light degradation, even though this layer is not exposed to light (14, 15). Currently only fluoropolymers can meet this standard. Firefighter advocates view this standard as non-essential and are advocating for PFAS-free turnout gear.

Studies reveal that the highest levels of PFAS in turnout gear are in the outer shell and moisture barrier (16, 17). Some PFAS were also found in the innermost thermal liner, which is concerning because PFAS are not intentionally added to this layer. This suggests that PFAS migrate to the thermal layer and can come in direct contact with the skin. PFAS can also accumulate on the surfaces of turnout gear from AFFF as well as from smoke and soot containing PFAS. When PFAS in furnishings and other items (such as stain-resistant carpeting and upholstery) burn during a fire, they can end up in the smoke and collect on firefighters' turnout gear.

Fire station dust

Several studies have found elevated levels of certain PFAS in dust samples from fire stations. For instance, a study of fire stations in the U.S. and Canada found dust levels of 4 long-chain PFAS (PFOS, PFOA, PFHxS, and PFNA) were higher in fire stations than in people's homes (18). Another study of fire stations in Massachusetts found higher dust levels of PFAS in turnout gear storage rooms compared with fire station living rooms (17).

What's being done to protect firefighters?

Based on the available science so far, removing PFAS from Class B foams and from turnout gear would greatly limit firefighters' exposures to PFAS. Manufacturers are searching for, developing, and selling alternatives to PFAS in foams and gear. Some laws have been passed to restrict AFFF use and disclose PFAS in firefighting materials. In 2018, Washington became the first state to require purchasers to be notified if their personal protective equipment (PPE) for firefighters contains PFAS and the purpose of adding PFAS to these products (19). A similar law in California took effect in January 2022 (20).

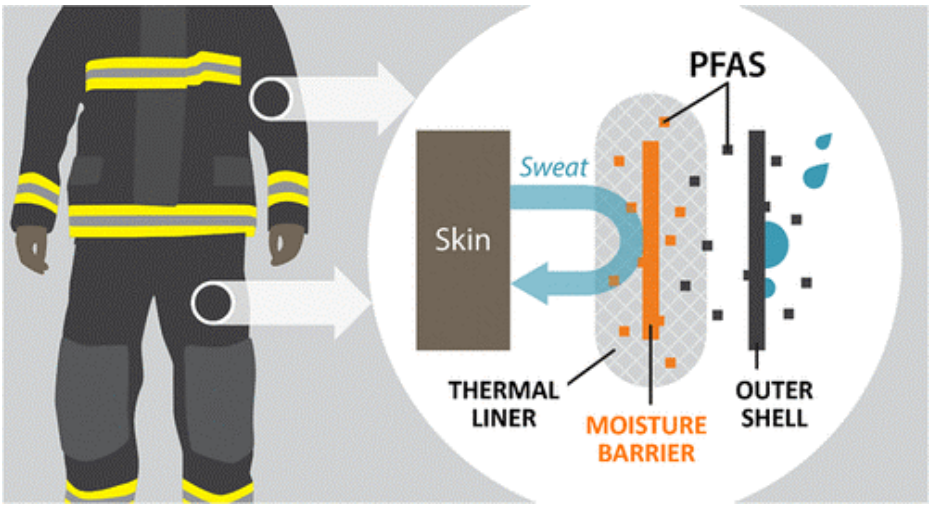

Image from Peaslee et al. (2020)

Manufacturers add PFAS to the outer shell of turnout gear to make it water-resistant. However, scientists have detected PFAS in the innermost layer as well, which suggests that PFAS migrate to the thermal liner, where it can come into contact with skin.

There are also many large-scale studies to monitor firefighters' exposures and health. At the national level, the 2018 Firefighter Cancer Registry Act established a voluntary registry of firefighters to collect information about cancer incidences, including firefighters from under-represented groups such as women and minorities (21). In 2021, the Michigan Department of Health and Human Services launched a biomonitoring program called PFAS in Firefighters of Michigan Surveillance to study PFAS exposures among firefighters (22).

How can firefighters reduce their exposures to PFAS?

- Minimize contact with AFFF and contaminated gear when possible.
- Wear clean PPE. After each use, clean contaminated turnouts, including hood, gloves, boots, SCBA masks, and helmets.
- Store turnout gear in closed lockers and/or gear bags. Avoid wearing turnout gear in living and sleeping areas or other times when not needed.
- Wash hands often, especially before preparing or eating food.
- Keep doors closed between the apparatus bay and living areas.
- Document exposures, injuries, or illnesses by completing personal exposure reports.
- Go PFAS-free. Ask your fire department or union to advocate for PFAS-free alternatives to firefighting foam and turnout gear.

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